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Port-A-Cath: A Real-Life Study in Patients Receiving Chemotherapy

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Abstract

Background: Chemotherapy delivered via Peripheral Venous Access (PVA) is associated with significant complications, including pain, swelling, and phlebitis. The Port-A-Cath (PAC) offers improved venous access and patient mobility during treatment.

Objective: This study aimed to assess the efficacy, safety, and quality-of-life impact of PAC in chemotherapy patients, comparing it with the traditional PVA method.

Methods: A single-centre, prospective cohort study was conducted at Bangladesh Specialized Hospital between 2019 and 2023, including 54 patients previously treated with PVA who subsequently transitioned to PAC. Pain and anxiety were assessed using the Visual Analogue Scale (VAS) and the Modified Facial Anxiety Scale (M-FAS), respectively. Patient satisfaction was assessed using a structured 5-point Likert-scale questionnaire administered at the end of the chemotherapy regimen. Paired t-tests were used to compare outcomes between PVA and PAC, with $p < 0.05$ considered statistically significant. Results: The mean age of participants was 49.7 years (SD 13.9) (M:F ratio = 1:1.7). During PVA use, patients underwent an average of 4.23 chemotherapy cycles (SD = 5.31) with a mean pain score of 4.0 (SD = 1.25); 64% reported moderate anxiety (M-FAS ≥4), and complications (chiefly phlebitis and extravasation) occurred in 64% of cases. After transition to PAC, the average number of cycles increased to 12 (SD = 7.85), the mean pain score fell to 1.4 (SD = 0.9), 80% of patients reported mild or no anxiety, and only 9.3% (5/54) experienced complications, mainly catheter-related infection. Statistically significant improvements were observed for pain ($p = 0.002$), anxiety ($p = 0.004$), and mobility restriction ($p = 0.001$). Unrestricted mobility was reported by 100% of patients with PAC compared with 50% during PVA use, and 92.6% of patients reported satisfaction with PAC.

Conclusion: Compared with PVA, PAC was associated with superior safety, efficacy, and patient comfort, with significant reductions in pain, anxiety, and mobility restriction during chemotherapy.

Keywords: Port-A-Cath; Peripheral Venous Access; Chemotherapy; Safety; Quality of Life.

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Introduction

The management of chemotherapy-related complications and the improvement of quality of life (QoL) in cancer patients remain central concerns in modern oncological research.[1] One of the most significant challenges faced by patients undergoing chemotherapy is the need for repeated venous access, which is frequently complicated by infection, thrombosis, or venous occlusion. To address these challenges, implanted central venous access devices, particularly the Port-A-Cath (PAC), have become increasingly common in the management of oncology patients.[2] The PAC system, an implantable venous access port, is intended to provide long-term venous access with a low complication rate, improving patient comfort and reducing the frequency of venepuncture.

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It is typically used to administer chemotherapy, draw blood samples, or deliver nutrition in patients undergoing prolonged treatment regimens. Although its adoption has become widespread, the actual efficacy, safety, and impact on quality of life remain topics of active investigation, particularly in real-world, single-centre settings.[3] The growing importance of personalised medicine in oncology necessitates an in-depth understanding of how devices such as the PAC affect not only the clinical trajectory of cancer treatment but also the broader patient experience.[4] Because the introduction of such a device often brings a significant shift in a patient's daily life and medical regimen, it is important to consider both the tangible clinical benefits and the subtler, more subjective aspects of patient well-being, including perceived quality of life.[5]

The PAC system consists of a small silicone catheter connected to a reservoir implanted beneath the skin, typically in the upper chest. It allows chemotherapy drugs to be administered directly into the bloodstream without repeated peripheral vein punctures. This not only reduces the discomfort associated with frequent needle insertions but also lowers the risk of vein scarring, extravasation, and phlebitis, which are common complications of long-term intravenous chemotherapy.[6] The catheter is tunnelled subcutaneously to the vein, providing secure vascular access, while the implanted port is equipped with a self-sealing membrane accessed through a needle. This closed system minimises the risk of infection and preserves the integrity of vascular access. Several studies have examined the safety profile of PAC in oncology patients, reporting relatively low rates of complications such as infection, catheter-related thrombosis, and device malfunction.[7] Despite its widespread use, however, data on the overall impact of PAC on patients' quality of life remain limited, with some studies reporting mixed results. While the device offers comfort and convenience, some patients experience anxiety related to its implantation, potential complications, and its physical presence in the body.[8] Concerns about the psychosocial impact of living with an implanted device, particularly regarding body image and self-esteem, have also been raised. It is therefore important to consider both objective clinical outcomes and subjective patient experience to provide a comprehensive assessment of PAC's value in oncology care.

Quality of life is a multidimensional concept encompassing physical, psychological, and social well-being. In the context of cancer treatment, QoL is strongly influenced by the frequency and severity of treatment-related side effects, the burden of hospital visits, and overall physical functioning.[9] PAC has the potential to alleviate some of these burdens relative to traditional chemotherapy administration by reducing pain and discomfort, decreasing the frequency of hospital visits, and allowing greater flexibility in the treatment regimen. The device's impact on QoL, however, is likely to vary with individual patient factors such as age, comorbidities, cancer type, and overall treatment plan.[10] Safety is an equally important consideration: although PAC has a generally favourable safety profile, the risk of complications such as infection, catheter-related thrombosis, and device failure persists. Catheter-related bloodstream infection (CRBSI) remains one of the most significant risks associated with central venous access devices, since the presence of a foreign body in the bloodstream creates a portal of entry for microorganisms; the self-sealing design of PAC reduces but does not eliminate this risk.[11] Thrombosis can also occur when blood clots form in or around the catheter, leading to obstruction or, in some cases, embolism, underscoring the need for regular monitoring and proper catheter care.[12] Well-designed studies evaluating the long-term safety and efficacy of PAC are therefore essential to confirm that its benefits outweigh its risks in patients undergoing chemotherapy.

Aims and Objectives

The primary aim of this study was to assess the real-life efficacy, safety, and quality-of-life impact of Port-A-Cath (PAC) in chemotherapy patients at a single centre, comparing outcomes with Peripheral Venous Access (PVA) in terms of pain, anxiety, complications, mobility, and patient satisfaction.

Materials And Methods

Study Design

This was a single-centre, prospective cohort study conducted at Bangladesh Specialized Hospital between 2019 and 2023. Fifty-four patients who had initially

received chemotherapy through PVA and subsequently transitioned to PAC were enrolled. For each patient, outcomes recorded during the PVA period served as the within-patient comparator for outcomes recorded after PAC insertion.

Inclusion Criteria

Patients with a confirmed diagnosis of cancer who were undergoing chemotherapy at Bangladesh Specialized Hospital, and who had initially received chemotherapy through PVA before being switched to PAC for continued treatment, were eligible for inclusion.

Exclusion Criteria

Patients were excluded if they had a prior surgery or condition that would interfere with PAC insertion, an active infection at enrolment, poor compliance with the chemotherapy regimen, or an inability to provide informed consent. Patients who had never received chemotherapy via PVA, or who had a known contraindication to PAC, were also excluded.

Procedure and Data Collection

After screening against the inclusion and exclusion criteria, 54 eligible patients were enrolled. Data were collected prospectively from the hospital's oncology database and patient medical records, and included demographic details, chemotherapy protocol, number of chemotherapy cycles, and duration of PVA and PAC use. Baseline data were recorded at the time of transition from PVA to PAC.

Pain was assessed using the Visual Analogue Scale (VAS), and anxiety was assessed using the Modified Facial Anxiety Scale (M-FAS), both administered before and after PAC insertion and compared with scores recorded during the PVA period. Mobility was assessed by recording whether patients experienced any restriction of movement during the venous access procedure and during the interval between sessions. Patient satisfaction with PAC was assessed using a structured 5-point Likert-scale questionnaire (very dissatisfied to very satisfied) administered to all patients at the completion of their chemotherapy regimen, with responses of "satisfied" or "very satisfied" classified as satisfied; the same instrument was used to record patients' perception of cost-effectiveness. Complications related to both PVA and PAC — including infection, catheter-related thrombosis, catheter kinking, extravasation, and the need for repositioning — were documented throughout follow-up. Patients were monitored at each visit for site-related findings, and those who developed complications received appropriate intervention. All patients were followed up until completion of their chemotherapy regimen, at which point patient-reported outcomes, complication rates, and changes in treatment-related quality of life were compiled for comparative analysis.

Data Analysis

Data were analysed using SPSS version 26.0. Descriptive statistics (mean, standard deviation, and percentage) were used to summarise patient demographics, chemotherapy cycles, pain scores, and anxiety levels. Paired t-tests were used to compare pain scores, anxiety levels, and mobility outcomes between the PVA and PAC periods within the same patients, and chi-square tests were used to compare categorical complication rates. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the ethical review board of Bangladesh Specialized Hospital. Written informed consent was obtained from all participants, and confidentiality was maintained by anonymising personal and medical data. Participants were informed that their involvement was voluntary and that they could withdraw at any time without affecting their treatment. All procedures complied with relevant ethical guidelines for medical research involving human participants.

Results

Data were analyzed for a cohort of 54 patients with respect to demographic characteristics, chemotherapy protocol, pain, anxiety, complications, mobility, satisfaction, and cost perception, comparing outcomes recorded during PVA use with those recorded after transition to PAC.

The mean age was 49.7 years (SD 13.9; range 6–71). The cohort was predominantly female (63.0%; 34 of 54) across a wide age range, with the largest age band being 51–60 years (29.6%). Colon cancer was the most common diagnosis (31.5%), followed by breast cancer (27.8%), and the FOLFOX/FOLFIRI protocol was the most frequently used chemotherapy regimen (51.9%).

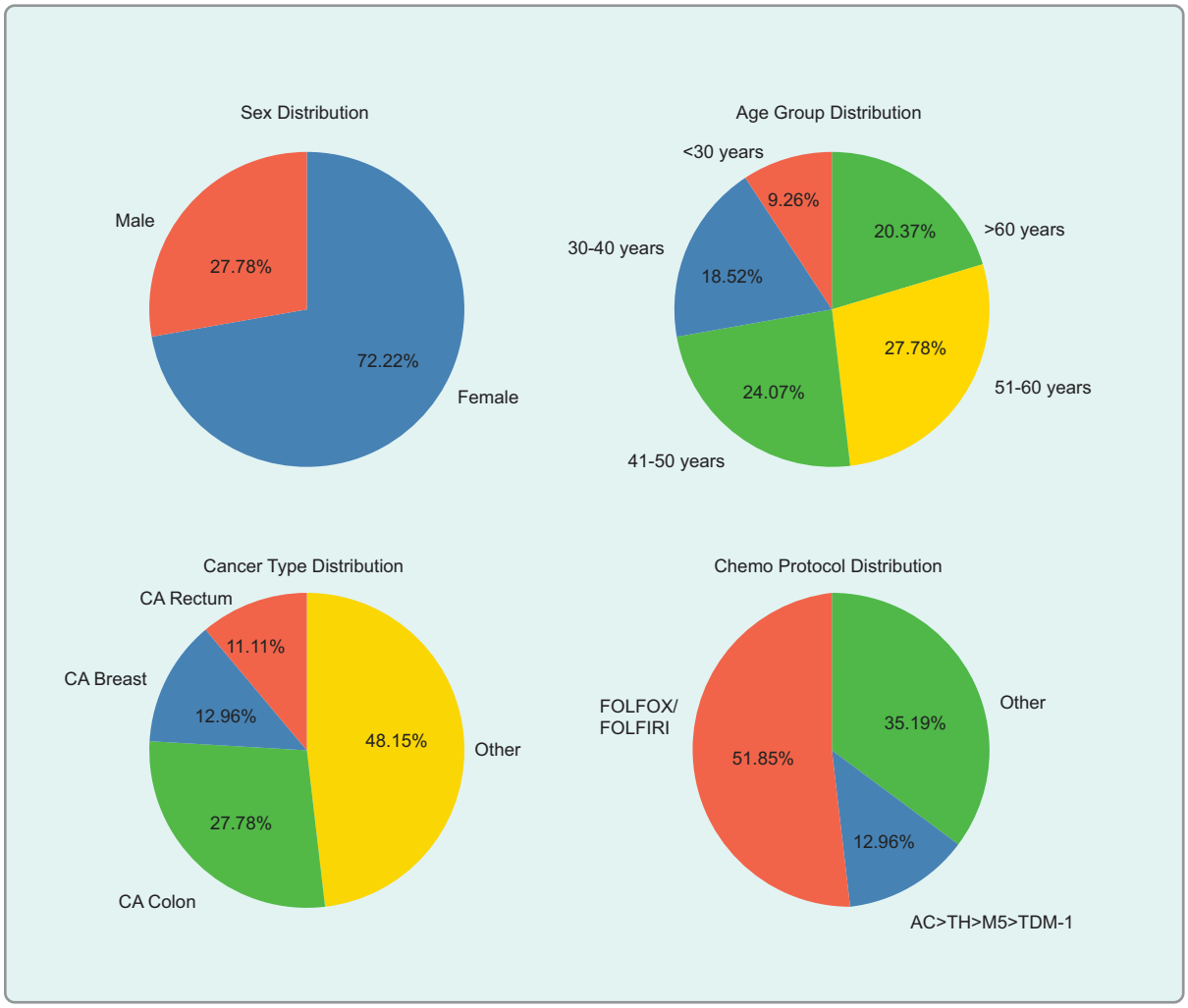

Figure 1: *Distribution of Demographic and Clinical Characteristics of the Study Population (n = 54)*

Table-I

Satisfaction with PAC versus Prior PVA, and Perceived Cost-Effectiveness (n = 54)

Variable	Frequency (n)	Percentage (%)
Satisfied with PAC	50	92.6%
Dissatisfied with PAC	4	7.4%
Satisfied with PVA (prior to PAC)	21	38.9%
Not satisfied with PVA (prior to PAC)	33	61.1%
Perceived PAC as cost-effective	45	83.3%
Did not perceive PAC as cost-effective	9	16.7%

Satisfaction and perceived cost-effectiveness were assessed using a structured 5-point Likert-scale questionnaire administered at the completion of chemotherapy (see Procedure and Data Collection). The large majority of patients reported satisfaction with PAC (92.6%), and most also regarded the device as cost-effective (83.3%) despite its higher upfront cost relative to PVA, reflecting favourable patient reception overall. Satisfaction was substantially higher with PAC than during the preceding PVA period: 50 of 54 patients (92.6%) were satisfied with PAC, compared with 21 of 54 (38.9%) who had been satisfied with PVA (McNemar test, $p < 0.001$; Table I).

Table-II

Complications Associated with Port-A-Cath (PAC) Compared with Peripheral Venous Access (PVA) (n = 54)

Complication Type	PVA, n (%)	PAC, n (%)	p-value
Phlebitis/Extravasation	35 (64.8%)	0 (0%)	<0.001
Catheter/Port-Site Infection	0 (0%)	2 (3.7%)	0.16
Catheter Kinking	0 (0%)	1 (1.9%)	0.32
Repositioning Required	0 (0%)	1 (1.9%)	0.32
Catheter Malfunction	0 (0%)	1 (1.9%)	0.32
Any Complication	35 (64.8%)	5 (9.3%)	<0.001
No Complication	19 (35.2%)	49 (90.7%)	<0.001

Overall, complications were markedly less frequent with PAC (5/54, 9.3%) than with PVA (35/54, 64.8%; p < 0.001). Among PAC-related complications, catheter or port-site infection was the most frequent single category (3.7%), followed by catheter kinking, repositioning, and catheter malfunction (1.9% each); none of these individual PAC complication categories differed significantly from one another in frequency. In contrast, phlebitis and extravasation accounted for nearly all complications during PVA use.

Mean pain score fell from 4.0 (SD = 1.25) with PVA to 1.4 (SD = 0.9) with PAC, an approximately 65% reduction in mean pain score (p = 0.002). Pain duration following venous access was also significantly shorter with PAC than with PVA (p = 0.001). Figure 2 shows the proportion of patients still reporting pain at successive time points after the procedure; this is a descriptive pain-duration curve and does not represent a survival or time-to-event analysis.

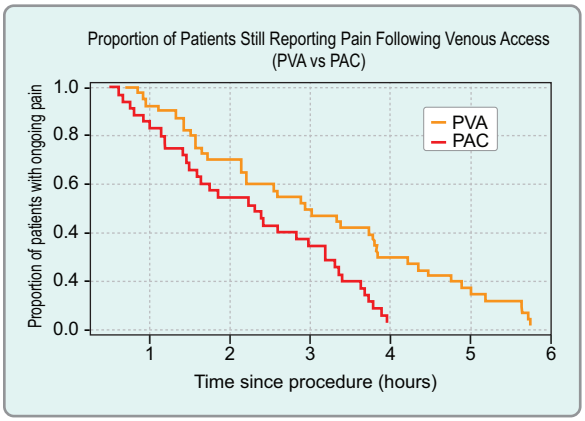

Figure 2: *Proportion of Patients with Ongoing Pain Following Venous Access, PVA versus PAC*

Table-III

Anxiety Levels with PVA versus PAC

Variable	PVA (n=54)	PAC (n=54)	p-value
Anxiety level (M-FAS)	Moderate (64%)	Mild/None (80%)	0.004
Anxiety duration (hours)	4.5 (2–8)	1.2 (0–3)	0.002
Anxiety reduction (%)	40%	70%	0.003

Anxiety, assessed using the M-FAS, was significantly lower with PAC: 80% of patients reported mild or no anxiety compared with 64% reporting moderate anxiety during PVA use. PAC was also associated with a shorter duration and greater overall reduction in anxiety (p = 0.004), indicating a more comfortable treatment experience.

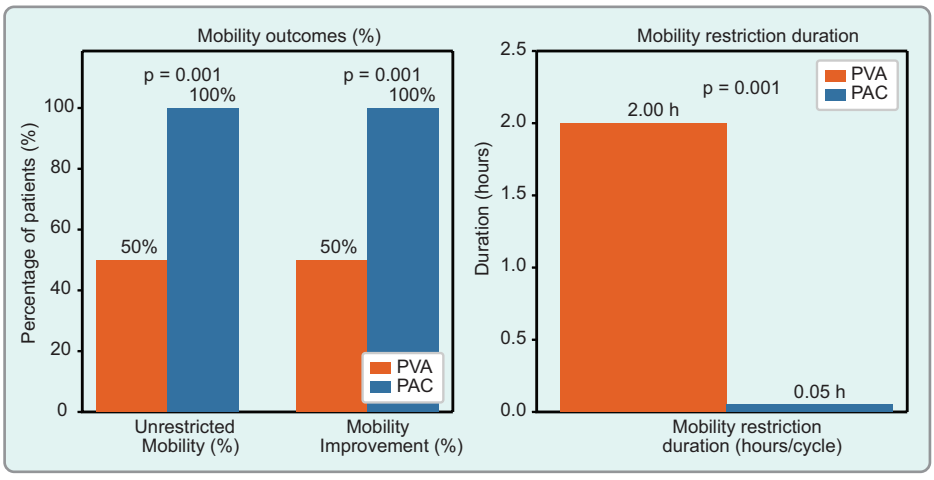

Figure 3: Mobility Outcomes and Duration of Mobility Restriction, PVA versus PAC

PAC was associated with a significant improvement in patient mobility: 100% of patients reported unrestricted mobility with PAC compared with 50% during PVA use ($p = 0.001$). The duration of mobility restriction per cycle was also markedly shorter with PAC (approximately 0.05 hours) than with PVA (approximately 2.0 hours; $p = 0.001$); because this duration measure is on a very different scale from the percentage-based outcomes, it is presented in a separate panel in Figure 3 for clarity.

Discussion

This study assessed the efficacy, safety, and quality-of-life impact of Port-A-Cath (PAC) compared with Peripheral Venous Access (PVA) in patients receiving chemotherapy.[13] The results indicate that PAC confers significant benefits over PVA in terms of pain reduction, anxiety management, mobility, and overall quality of life, consistent with, and in some respects extending, the findings of previous studies. These results are discussed below in relation to the existing literature, together with their clinical implications.

Pain Management

A key finding of this study was the significant reduction in pain associated with PAC, with mean pain scores falling from 4.0 with PVA to 1.4 with PAC. This is consistent with several previous studies that have reported reduced pain with PAC relative to PVA. Haslik *et al.* similarly found that PAC reduced pain in chemotherapy patients, with mean pain scores falling from 3.8 to 2.1 following the switch from PVA to PAC.[2] Our findings are also consistent with those of Blanco-Guzman *et al.*, who reported reduced pain with PAC owing to the secure nature of the implanted device, which eliminates the need for repeated needle insertion.[7]

Pain associated with repeated venous puncture in PVA patients can be severe, particularly as veins become fragile after multiple accesses over a prolonged period. This was reflected in our cohort, where the high number of needle insertions and increasing difficulty of venous access contributed to higher pain scores in PVA patients. These findings support the broader literature indicating that PAC provides a more stable and comfortable access route for chemotherapy, thereby reducing treatment-related pain and discomfort.

Gabay *et al.* similarly note that extravasation — the leakage of chemotherapy drugs into surrounding tissue — occurs more frequently with PVA, leading to additional pain and tissue damage.[14] PAC is considerably less prone to extravasation owing to its implanted nature, which likely contributes to the lower pain scores observed in this and other studies, and supports its use as a preferred venous access method for patients undergoing multiple cycles of chemotherapy.

Anxiety and Psychological Impact

A further significant finding was the reduction in anxiety among PAC patients: 80% reported mild or no anxiety during chemotherapy, compared with 64% who reported moderate anxiety during PVA use. This is consistent with the findings of Zapletal *et al.*, who reported lower anxiety levels among PAC patients owing to the secure and stable access point it provides.[3] The greater stability of PAC, relative to the discomfort and unpredictability often associated with PVA, likely contributes to this reduction in anxiety.

Anxiety is common among patients undergoing chemotherapy and is often exacerbated by the repeated need for venous access; the psychological burden of repeated needle insertion, fear of complications, and pain associated with PVA can all heighten anxiety. This is in line with the findings of Rutkowski *et al.*, who reported higher anxiety levels among patients with PVA owing to the repeated need for access.[15] Our findings also support those of Zapletal *et al.*, who reported improved emotional well-being among PAC patients owing to fewer medical procedures and a greater sense of security.[3]

The psychological impact of chemotherapy and its associated procedures can significantly affect a patient's ability to cope with the disease. The reduction in anxiety observed with PAC in this study suggests that the device provides not only physical benefit but also plays a meaningful role in supporting patients' emotional and psychological well-being, likely by fostering a greater sense of stability and control over the treatment process.

Mobility and Quality of Life

The improvement in mobility observed with PAC was another notable finding: 100% of patients reported unrestricted mobility during chemotherapy sessions with PAC, compared with 50% who experienced restrictions during PVA use. This is consistent with previous studies reporting fewer mobility restrictions with PAC.[12] The ability to move freely during

chemotherapy allows patients to maintain daily activities and a sense of normalcy during treatment, which can meaningfully improve quality of life.

Unrestricted mobility is particularly important for patients undergoing long-term chemotherapy, since mobility restriction can contribute to feelings of frustration and helplessness. Mobility has previously been identified as a critical factor in emotional and physical well-being during chemotherapy, whereas PVA is often associated with restriction owing to repeated access-site manipulation and the discomfort of each needle insertion. By reducing the need for repeated needle insertion, PAC appears to allow patients to maintain better mobility and overall functioning during chemotherapy, supporting improved quality of life.

Because quality of life during chemotherapy can substantially affect patients' psychological state and their capacity to maintain normal daily activities, the unrestricted mobility associated with PAC in this study is relevant not only to physical comfort but also to emotional and psychological well-being.

Complications and Safety

In terms of safety, PAC was associated with a markedly lower complication rate than PVA, with complications — chiefly catheter or port-site infection, kinking, malfunction, and the need for repositioning — occurring in 9.3% (5/54) of patients, compared with 64.8% (35/54) of patients during PVA use ($p < 0.001$). This complication rate with PAC is broadly consistent with the low complication rates reported for implantable ports in previous single-centre series,[6] underscoring the favourable safety profile of PAC when properly inserted and maintained.

The substantially higher complication rate observed with PVA in this study, driven primarily by phlebitis and extravasation, is consistent with the findings of Medlej *et al.*, who reported an elevated risk of complications with PVA owing to repeated needle insertion and the fragility of peripheral veins.[16] Phlebitis in particular is a recognized complication of PVA, arising from inflammation of the vein due to repeated irritation from the catheter or needle.[15] These findings highlight the safety benefits of PAC, particularly its potential to reduce complications that can necessitate additional medical intervention or prolonged hospitalization.

It should be noted that, although PAC was associated with fewer complications overall, the device is not risk-free: a small proportion of patients in this study (9.3%) experienced catheter or port-site infection, kinking, malfunction, or required repositioning. These complications were generally mild and resolved with appropriate intervention. Comparable findings were reported by Blanco-Guzman *et al.*, who similarly observed a lower overall complication rate with PAC relative to PVA, alongside occasional infection and catheter malfunction.[7]

Cost Considerations

Despite its higher initial cost, the long-term benefits of PAC — including fewer complications, fewer hospital visits, and improved patient comfort — appear to make it a cost-effective option for many patients. In this study, 83.3% of patients regarded PAC as cost-effective (Table 1), a finding consistent with that of Zapletal *et al.*, who reported that PAC, although more expensive upfront, ultimately yields cost savings by reducing complications and hospital readmission.[3]

Cost-effectiveness is an important consideration, particularly in resource-limited healthcare settings. Although PAC carries a higher upfront cost than PVA, the reduction in complications and the overall improvement in patient quality of life observed in this study suggest that the investment may be justified. Future research should further explore the long-term economic benefits of PAC in resource-limited settings, to determine more precisely whether its upfront cost is offset by reductions in treatment-related complications and hospitalization.

Patient Satisfaction

The high level of satisfaction reported by patients in this study (92.6%) is in keeping with previous reports that totally implantable ports are generally well accepted by patients undergoing chemotherapy. In a comparison of PICC and PICC-port devices in women receiving neoadjuvant chemotherapy, Pinelli *et al.* reported that a port-based device was associated with a more favourable patient experience,[9] while D'Souza *et al.* similarly described generally favourable patient outcomes with totally implantable ports in routine oncology care.[4] Our findings add real-world support from a resource-limited setting, where acceptability and comfort are particularly relevant to treatment continuity.

Limitations

This study has several limitations. The sample size was relatively small (54 patients), and the study was conducted at a single institution, which may limit the generalizability of the findings. Outcomes were assessed only for the duration of the chemotherapy regimen, so the longer-term impact of PAC on survival, cancer recurrence, or other post-treatment factors remains unexplored. In addition, because all patients served as their own PVA-to-PAC comparator rather than being randomized, the observed improvements may be partly influenced by the sequence of exposure or by changes in disease status over time. Future studies should employ larger, multi-centre cohorts, ideally with randomized or parallel-group designs, and should examine the long-term effects of PAC use in patients with cancer.

Conclusion

This study indicates that, compared with Peripheral Venous Access, Port-A-Cath is associated with superior efficacy, safety, and patient satisfaction in patients receiving chemotherapy. PAC was associated with significant reductions in pain, anxiety, and mobility restriction, together with a lower complication rate and improved patient comfort, supporting its use as a valuable alternative to PVA. Future research should further explore the long-term outcomes, cost-effectiveness, and impact of PAC on treatment continuity across diverse healthcare settings.

Recommendations

1. Given its demonstrated benefits, healthcare providers should consider PAC as the preferred method of venous access for patients undergoing multi-cycle chemotherapy.
2. Future studies should formally assess the long-term financial and clinical benefits of PAC relative to PVA.
3. Larger, multi-center studies, ideally with randomized or parallel-group designs, should be conducted to validate these findings across diverse patient populations.

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