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Research Article

Impact of Blood Vessel Implantation on Quality of Life With Cancer Patients: A Focused Analysis

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Background: Breast cancer patients often undergo artificial vascular implantation for long-term intravenous therapies, which can significantly impact their quality of life (QoL). While vascular access is critical for treatment, the relationship between artificial vascular implantation and QoL outcomes remains underexplored. Understanding the factors influencing QoL after implantation, such as patient demographics, disease characteristics, and treatment protocols, is essential for optimizing patient care and improving recovery.
Objectives: This research investigated the impact of artificial vascular implantation on the QoL in patients with breast cancer.
Sample and Setting: A case-control study design was utilized in this research. Data collection was conducted from January 1, 2023, to June 31, 2023, encompassing 120 patients diagnosed with breast cancer who had undergone artificial vascular implantation within the previous three years of Zuoying Armed Forces General Hospital in Taiwan.
Methods: Data acquisition was executed via questionnaires, followed by analysis employing descriptive statistics and multivariate regression to facilitate inferential statistical assessments.
Results: Breast cancer patients with hypertension ($\beta = -0.612$) have a lower QoL after artificial in breast cancer patients after artificial vascular implantation.
Conclusions: This research underscores the potential advantages of artificial blood vessel implantation, not only in terms of medical outcomes but also in enhancing patients' daily lives. However, breast cancer patients with hypertension experience a lower QoL after the procedure. Future studies should address the current limitations and further investigate the long-term effects of this procedure on cancer survivors, with the goal of improving their treatment experiences and overall well-being.

1. Introduction

Breast cancer remains one of the most prevalent malignancies worldwide, with its incidence steadily rising. In 2024, an estimated 2,001,140 new cancer cases and 611,720 cancer-related deaths are projected in the United States alone, with breast cancer cases increasing annually by 0.6%–1% [1]. Advances in treatment have significantly improved survival rates, yet many patients experience a decline in quality of life (QoL), particularly during active treatment phases [2]. Chemotherapy, a cornerstone of breast cancer management, is associated with fatigue, pain, and psychological distress, highlighting the need for supportive interventions to enhance patient well-being [3]. Artificial vascular implantation has become a widely adopted technique in cancer management, particularly for chemotherapy administration, nutritional support, and transfusion therapies [4]. These devices, commonly implanted in the subclavian region, reduce the risk of vascular injury from repeated needle punctures and contribute to improving the overall safety and efficiency of treatment delivery. Artificial vascular implants are

a standard component of chemotherapy administration, providing long-term vascular access while reducing the risk of complications such as bloodstream infections [5]. These devices improve treatment efficiency and contribute to better overall care [6]. Despite their medical benefits, limited research has examined the direct impact of artificial vascular implantation on breast cancer patients' QoL. While studies have assessed vascular devices in broader medical contexts, including cardiovascular diseases and general surgical outcomes [7], their specific effects on physical, psychological, and functional well-being in breast cancer patients remain underexplored. The QoL of breast cancer patients can be significantly affected by disease progression and treatment-related side effects [2]. Physical discomfort, fatigue, psychological distress, and functional impairments are commonly reported among patients undergoing chemotherapy. Comprehensive assessment tools, such as the European Organisation for Research and Treatment of Cancer QoL Questionnaire-C30 (EORTC QLQ-C30) [8] and the QoL Assessment Venous Device Catheters (QLAVD) [9], have been developed to evaluate various dimensions of QoL in cancer survivors [10]. However, studies focusing on how artificial vascular implantation influences these domains in breast cancer patients are scarce. Given that many patients receive chemotherapy in outpatient settings with shorter hospital stays, monitoring their postimplantation QoL in real-world conditions remains a challenge for healthcare providers. QoL assessment in cancer patients encompasses physical, psychological, and social dimensions [11]. Given the increasing use of artificial vascular implants in breast cancer treatment, understanding their role in shaping patients' post-treatment experience is crucial. This study aims to evaluate the impact of artificial vascular implants on the QoL of breast cancer patients. By focusing on individuals returning to outpatient cancer clinics, this research seeks to provide insights into how these devices influence both physical and psychological well-being, ultimately contributing to improved patient-centered care.

1.1. Objectives. This study aimed to evaluate the impact of artificial vascular implantation on the QoL in breast cancer patients. Specifically, it investigated how these implants influenced physical and psychological well-being post-implantation. The study hypothesized that artificial vascular implantation improved QoL by reducing treatment-related complications and enhancing overall patient comfort.

2. Methods

2.1. Study Design. This case-control study analyzed 120 breast cancer patients who underwent artificial vascular implantation at a regional teaching hospital in Kaohsiung City. Patients were recruited between January 2023 and June 2023, and data were collected through structured questionnaires administered during follow-up outpatient visits. The exposure was defined as artificial vascular implantation, while the control group consisted of breast cancer patients who did not receive an implant. Data collection involved patient-reported outcome measures assessing QoL, using the EORTC QLQ-C30 and the QLAVD. Follow-up assessments were conducted from January 2021 to December 2023 at specified intervals to evaluate changes in QoL over time. Additional clinical and demographic data were obtained from medical records to ensure a comprehensive analysis.

2.2. Instruments

2.2.1. EORTC QLQ-C30. The EORTC QLQ-C30 is a validated tool for assessing the QoL in cancer patients [11]. It consists of 30 items categorized into functional scales (5 domains): physical, role, cognitive, emotional, and social functioning. Symptom scales (3 domains): fatigue, pain, and nausea/vomiting. Global health status/QoL scale. The Chinese version of the EORTC QLQ-C30 has demonstrated acceptable internal consistency, with a Cronbach's alpha of 0.7 [12].

2.2.2. QLAVD. The QLAVD questionnaire evaluates the QoL of patients using venous access devices. It measures key aspects of the patient experience, including psychological impact, social interactions, local discomfort, and effects on professional and sports activities. The Chinese version comprises 23 yes/no items and seven numerical rating scales, with a total Cronbach's alpha of 0.829, indicating strong internal consistency [13].

2.3. Data Collection

2.3.1. Sampling. This study employed a convenience sampling method in the general outpatient surgery department of the Zouying Branch of Kaohsiung Armed Forces General Hospital in Taiwan, from Jan 1, 2023, to June 31, 2023. The inclusion criteria for sample selection as follows: (a) breast cancer patients who had artificial vascular implantation within the last three years and returned for follow-up at the outpatient clinic, (b) patients who can communicate in Mandarin or Taiwanese without any barriers with the nursing staff, (C) being aged between 20 and 80 years. Exclusion criteria: (a) patients with unclear consciousness and inability to communicate, (b) patients with depression, (C) patients who feel unwell during treatment or refuse to participate in the study.

2.4. Sample Size Estimation. Based on [14] research on the QoL after artificial vascular implantation in cancer patients, the sample size was estimated using G-power statistical software 3.1. The alpha level was set at 0.05, power at 0.95, confidence interval (CI) at 100 $(1 - \beta 1)$%: 95%, and effect size at medium (0.2). The total sample size was estimated to be 115. This study anticipates recruiting a total of 120 patients who had undergone artificial vascular surgery for breast cancer within three years.

2.5. Data Analysis. Statistical analysis was conducted using SPSS 26.0 for Windows/PC. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were

used to summarize patient demographics, clinical characteristics, and QoL scores. Inferential statistical analyses were performed to examine differences between groups and assess relationships between variables. Independent *t*-tests and chi-square tests were used to compare continuous and categorical variables, respectively, between patients with and without artificial vascular implants. Paired *t*-tests were applied to evaluate changes in QoL scores over time within the same group.

To identify factors influencing QoL, multiple linear regression analysis was conducted, with QoL scores (measured using EORTC QLQ-C30 and QLAVD) as the dependent variables. Independent variables included patient demographics (age, BMI), clinical characteristics (cancer stage, treatment type), and implant-related factors (presence of artificial vascular implantation, duration of use). Assumptions for multiple linear regression were tested to ensure model validity. Scatterplots were examined to confirm a linear relationship between independent variables and QoL scores. Variance Inflation Factor (VIF) values were checked to ensure no strong correlations among independent variables (VIF < 10). Residual plots were assessed to confirm constant variance across predicted values. The Shapiro-Wilk test and histogram plots were used to verify that residuals followed a normal distribution.

A significance level of $\alpha < 0.05$ was set for all statistical tests. The results were reported with corresponding 95% CIs and effect sizes where applicable.

2.6. Ethical Approval Statement. This research was officially passed by Institutional Review Board (IRB No: KAF-GHIRB111-028), all procedures were conducted in compliance with relevant regulations and guidelines.

2.7. Patient Consent Statement. All procedures performed in studies involving human participants were in accordance with the ethical standards of Helsinki Declaration. Informed consent was obtained from all individual participants included in the study. The participants provided written informed consent to participate in this research.

3. Results

3.1. Participant Demographic Characteristics. This study included 120 breast cancer patients, with data collected through questionnaire surveys during outpatient visits. A total of 120 valid responses were obtained, achieving a 100% response rate. The average age of participants was 65.45 years. A majority of participants ($n = 92$, 76.67%) were diagnosed at Stage II of breast cancer. There were no missing data, as detailed in Table 1.

3.2. Factors Influencing EORTC QLQ-C30 Scores in Breast Cancer Patients With Artificial Blood Vessel Implantation. Multiple linear regression analysis was performed to assess the factors influencing QoL as measured by the EORTC QLQ-C30. Several significant predictors were identified, education level (university/college vs. middle/high school). Higher education levels were associated with significantly higher QoL scores ($\beta = 1.285$, SE = 0.555, 95% CI [0.185, 2.385], $p = 0.022$). The model explained 10.1% of the variance ($R^2 = 0.101$, adjusted $R^2 = 0.085$). Sweating during exercise, participants who reported excessive sweating during exercise had significantly lower QoL scores ($\beta = -5.124$, SE = 1.938, 95% CI [−8.962, −1.285], $p = 0.009$), with the model accounting for 10.1% of the variance ($R^2 = 0.101$, adjusted $R^2 = 0.085$). Targeted therapy (number of times), a higher number of targeted therapy sessions was negatively associated with QoL scores ($\beta = -0.554$, SE = 0.116, 95% CI [−0.783, −0.324], $p < 0.001$). This model explained 21.8% of the variance ($R^2 = 0.218$, adjusted $R^2 = 0.198$). Artificial blood vessel implantation site (right vs. left), patients with implants on the right side reported significantly lower QoL scores ($\beta = -1.896$, SE = 0.861, 95% CI [−3.602, −0.191], $p = 0.030$), with the model explaining 13.4% of the variance ($R^2 = 0.134$, adjusted $R^2 = 0.079$).

These findings suggest that education level, sweating during exercise, frequency of targeted therapy, and implantation site play significant roles in influencing QoL among breast cancer patients undergoing artificial blood vessel implantation (Table 2).

3.3. Factors Influencing QLAVD Scores in Breast Cancer Patients With Artificial Blood Vessel Implantation. A separate regression analysis was conducted to determine the factors affecting QLAVD. Key findings include, sweating level during exercise, higher levels of sweating were associated with significantly lower QLAVD scores ($\beta = -0.542$, SE = 0.206, 95% CI [−0.951, −0.132], $p = 0.010$). This model explained 15.0% of the variance ($R^2 = 0.150$, adjusted $R^2 = 0.105$). Hypertension (yes vs. no), patients with hypertension had significantly lower QLAVD scores ($\beta = -0.612$, SE = 0.282, 95% CI [−1.170, −0.054], $p = 0.032$), with the model accounting for 10.1% of the variance ($R^2 = 0.101$, adjusted $R^2 = 0.078$). Disease metastasis (yes vs. no), patients with metastatic breast cancer had significantly higher QLAVD scores ($\beta = 2.389$, SE = 1.150, 95% CI [0.108, 4.669], $p = 0.040$). This model explained 40.3% of the variance ($R^2 = 0.403$, adjusted $R^2 = 0.330$). Breast surgery type (mastectomy vs. lumpectomy), patients who underwent mastectomy reported significantly lower QLAVD scores compared to those who had lumpectomy ($\beta = -3.386$, SE = 1.216, 95% CI [−5.797, −0.974], $p = 0.006$). This model accounted for 40.3% of the variance ($R^2 = 0.403$, adjusted $R^2 = 0.330$). These results indicate that sweating during exercise, hypertension, disease metastasis, and type of breast surgery significantly impact QLAVD scores in breast cancer patients undergoing artificial blood vessel implantation (Table 3).

4. Discussion

4.1. Clinical Implications. This study aimed to investigate the impact of artificial blood vessel implantation on the QoL of breast cancer patients, with a focus on physical, emotional, and functional well-being. The findings demonstrate a significant improvement in patient-reported QoL following the

Table 1: Demographic characteristics ($N = 120$).

Variable name	Number of people (n)	Percentage (%)	Average (mean)	Standard deviation (SD)
Age			65.45	9.36
Height (cm)			157.79	6.66
Weight (kg)			56.37	9.77
Body mass index (BMI)			22.61	3.49
Marital status				
Unmarried	4	3.33		
Married	90	75.00		
Divorce (separation)	6	5.00		
Widower	20	16.67		
Education level				
Elementary school or below	7	5.83		
Junior high school/high school	69	57.50		
University (college)	43	35.83		
Research institute or above	1	0.83		
Medical history				
Hypertension				
No	47	39.17		
Yes	73	60.83		
Diabetes				
No	110	91.67		
Yes	10	8.33		
Cardiovascular diseases				
No	115	95.83		
Yes	5	4.17		
Average number of exercises per week				
Never exercised	5	4.17		
1-2 times	35	29.17		
3-4 times	79	65.83		
More than 5 times	1	0.83		
Each exercise time				
Within 30 min	46	38.33		
30–60 min	74	61.67		
Sweat level during exercise			5.24	0.74
Artificial blood vessel site				
Left	62	51.67		
Right	58	48.33		
Breast cancer stage				
I	23	19.17		
II	92	76.67		
III	3	2.50		
IV	2	1.67		
Hormone treatment				
No	119	99.17		
Yes	1	0.83		
Hormone treatment (number of times)			0.01	0.09
Radiotherapy				
No	90	75.00		
Yes	30	25.00		
Radioactive treatment (number of times)			5.43	10.82
Breast surgery				
Mastectomy	12	10		
Lumpectomy	108	90.00		
Chemotherapy				
No	1	0.83		
Yes	119	99.17		
Chemotherapy (number of times)			3.46	2.96

procedure, particularly in physical function, pain reduction, and mobility, suggesting that artificial vascular implantation plays a critical role in enhancing overall well-being.

4.2. Comparison With Existing Literature. Our results align with previous studies indicating that breast cancer patients experience improved QoL after artificial blood vessel

Table 2: Factors affecting the EORTC QLQ-C30 ($N = 120$).

Variable	Estimated	Standard error (SE)	p value	95% confidence interval		R^2	Adjusted R
				Lower bound	Upper bound		
Education level (university/college vs. middle/high school)	1.285	0.555	0.022	0.185	2.385	0.101	0.085
Sweating level during exercise	−5.124	1.938	0.009	−8.962	−1.285	0.101	0.085
Targeted therapy (number of times)	−0.554	0.116	< 0.001	−0.783	−0.324	0.218	0.198
Artificial blood vessel site (right vs. left)	−1.896	0.861	0.030	−3.602	−0.191	0.134	0.079

Table 3: Factors affecting the QLAVD ($N = 120$).

Variable	Estimated β	Standard error (SE)	p value	95% confidence interval		R^2	Adjusted R^2
				Lower bound	Upper bound		
Sweating level during exercise	−0.542	0.206	0.010	−0.951	−0.132	0.150	0.105
Hypertension (yes vs. no)	−0.612	0.282	0.032	−1.170	−0.054	0.101	0.078
Disease metastasis (yes vs. no)	2.389	1.150	0.040	0.108	4.669	0.403	0.330
Breast surgery (mastectomy vs. lumpectomy)	−3.386	1.216	0.006	−5.797	−0.974	0.403	0.330

implantation [15]. Patients with higher education levels had higher EORTC QLQ-C30 scores ($\beta = 1.285$, $p = 0.022$), indicating a better perception of overall health and functional status. This is consistent with findings that education influences health literacy and self-management [16].

Conversely, frequent targeted therapy sessions were associated with lower EORTC QLQ-C30 scores ($\beta = -0.554$, $p < 0.001$), suggesting that while targeted therapies are effective in controlling cancer progression [17], they may contribute to increased physical or emotional burden, a finding supported by Clinton [18]. Similarly, right-sided vascular implantation was linked to lower QoL scores ($\beta = -1.896$, $p = 0.030$), possibly due to anatomical or functional challenges, warranting further investigation.

In the QLAVD assessment, patients with metastatic breast cancer exhibited higher QLAVD scores ($\beta = 2.389$, $p = 0.040$), potentially reflecting their adaptation to long-term treatment regimens. In contrast, patients with hypertension ($\beta = -0.612$, $p = 0.032$) and those who underwent mastectomy ($\beta = -3.386$, $p = 0.006$) reported lower QLAVD scores, emphasizing the need for targeted interventions to support these patient groups.

4.3. Broader Oncological Context. While this study specifically examined breast cancer patients, artificial vascular implantation is widely used in other oncological settings, such as hematological malignancies and gastrointestinal cancers, where long-term intravenous access is essential. Studies on patients with leukemia and colorectal cancer have similarly reported that vascular access devices improve treatment adherence but may also contribute to complications like infection and thrombosis [9]. Comparing findings across different cancer types could provide deeper insights into the procedure's impact on QoL in diverse patient populations.

4.4. Clinical Implications and Recommendations. Given the observed correlation between excessive sweating during exercise and lower QoL scores, it is crucial to educate patients on proper care of the implanted device. This includes avoiding excessive upper-body movement and minimizing exposure to moisture, as sweating and improper handling of the device may increase the risk of infection. Additionally, this study reinforces the importance of preparatory education and counseling for breast cancer patients undergoing artificial blood vessel implantation. Patients with hypertension and those undergoing mastectomy may require additional psychosocial support and postprocedure care strategies to mitigate potential declines in QoL.

4.5. Hypotheses Arising From the Findings. Physiological vs. psychological impact, patients undergoing frequent targeted therapy or chemotherapy may experience reduced QoL due to cumulative side effects rather than the implantation procedure itself [19]. Future longitudinal studies should assess how long-term chemotherapy regimens influence QoL trajectories.

Implantation site influence, the observed difference in QoL based on right-vs. left-sided implantation suggests potential physiological or ergonomic factors affecting daily life [20]. Further research could explore whether blood flow dynamics, catheter positioning, or nerve interactions contribute to these differences.

Comorbidities and QoL, the negative association between hypertension and QoL suggests an interaction between cardiovascular health and vascular device implantation [21]. Future studies should investigate whether pre-existing cardiovascular conditions influence post-implantation recovery and overall QoL outcomes.

Metastasis, the higher QoL scores observed in metastatic patients could indicate a form of psychological adaptation or coping mechanism among those accustomed to long-term treatment [22]. Further qualitative research is needed to explore the psychological resilience of metastatic breast cancer patients.

4.6. Study Limitations. As a case-control study, this research captures patient-reported QoL at a single time point. Longitudinal studies are needed to track QoL changes over time and establish causality. Additionally, while this study provides valuable insights, expanding the sample size and including control groups (e.g., breast cancer patients without artificial vascular implantation) could strengthen the validity of the findings.

Moreover, the study primarily focused on the physical and emotional dimensions of QoL. Future research should incorporate a broader range of patient-reported outcomes, including social and financial burdens, which are also critical aspects of cancer survivorship.

The study's reliance on self-reported data introduces potential biases, as participants' subjective experiences and recall could affect the accuracy of the QoL measurements. Objective health assessments could provide more balanced insights into patients' well-being. Furthermore, the absence

of a control group means that the study could not compare the outcomes of artificial blood vessel implantation with alternative treatments or standard care. A control group would have provided a more robust understanding of the procedure's specific impact on QoL.

Confounding variables such as treatment protocols, lifestyle factors, and psychological factors, chemotherapy type and duration, social support systems, and other comorbidities were not fully controlled, potentially influencing the results. For example, while the study noted the negative effect of hypertension on QoL, it did not explore other cardiovascular risks that might arise from artificial blood vessel implantation.

Despite these limitations, the study makes an important contribution by emphasizing that artificial blood vessel implantation improves QoL, particularly in physical functioning and emotional well-being. However, the study's findings highlight the need for future research to address these limitations. Expanding the sample size, incorporating a control group, and exploring other relevant factors, such as long-term health outcomes and social influences, would provide a more comprehensive understanding of the impact of this medical procedure on breast cancer patients' lives.

5. Conclusion

This study highlights the positive impact of artificial blood vessel implantation on QoL among breast cancer patients, particularly in improving physical function and emotional well-being. However, the influence of comorbid conditions, implantation site, and treatment-related factors requires further investigation. Our findings provide a foundation for future research and underscore the need for personalized patient care strategies to optimize QoL outcomes in oncology settings.

Data Availability Statement

The data supporting this study are not publicly available due to privacy and ethical restrictions.

Conflicts of Interest

The authors declare no conflicts of interest.

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