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ORIGINAL RESEARCH

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Longitudinal study on symptom clusters of patients undergoing breast reconstruction surgery after breast cancer

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Abstract

This study aims to explore the composition and dynamic changes of symptom clusters in breast cancer patients at various time points after breast reconstruction, offering insights for better symptom management post-surgery. A total of 120 breast cancer patients who received breast reconstruction surgery at our hospital from January 2021 to October 2023 were included in this retrospective study. Information regarding patient demographics and disease characteristics was gathered. The Chinese version of the Memory Symptom Assessment Scale to evaluate patients at admission (T1, 120 cases), 1-day post-surgery (T2, 116 cases), 1-week post-surgery (T3, 111 cases), 1-month post-surgery (T4, 104 cases), 3 months post-surgery (T5, 84 cases), 6 months post-surgery (T6, 76 cases) and 12 months post-surgery (T7, 64 cases). At each time point, there were 15, 17, 19, 16, 13, 12 and 9 symptoms respectively, with a prevalence rate exceeding 20%. The analysis through exploratory factorization disclosed that the peak prevalence of symptoms over 20% was observed at T3. Factorization of all symptoms at T3 delineated 6 distinct clusters of symptoms: autonomic dysfunction, fatigue, somatic dysfunction, psychological dysfunction, neurological and sensory symptoms and sleep-related symptoms. Breast cancer patients undergoing breast reconstruction experience multiple symptom clusters. The core symptoms within these clusters remain relatively stable over time. Healthcare professionals should conduct dynamic assessment and strengthen the coordinated management of these symptom clusters.

Keywords

Breast cancer; Post-reconstruction surgery; Symptom clusters; Psychological symptoms; Body image disturbance; Gastrointestinal symptoms; Symptom distress; Longitudinal study

1. Introduction

Breast cancer is one of the most common cancers among women globally [1]. In 2020, there were an anticipated 2.2614 million new cases of female breast cancer worldwide, accounting for 25.84% of all newly diagnosed malignant tumors in women, and 685,000 deaths, accounting for 15.56% of all female cancer fatalities [2, 3]. Treatment strategies for breast cancer encompass a range of options, such as surgery, chemotherapy, radiation therapy, endocrine therapy and targeted therapy. Among these, surgery and chemotherapy are considered the cornerstone treatments for breast cancer [4, 5]. However, for many women, breast removal surgery causes both physical and emotional distress. Due to improved comprehensive care, patients are now experiencing extended survival rates, resulting in a growing need for breast reconstruction surgery among mastectomy patients with breast cancer [6]. Breast reconstruction surgery, as an important therapeutic approach, not only restores the aesthetic appearance of the breast but also positively impacts patients' psychological health and quality of life [7, 8]. Despite the evident benefits, individuals who undergo surgery still encounter difficulties in adjusting to postoperative life and dealing with psychological challenges. These difficulties include alterations in self-perception, regaining physical abilities and worries about their future health, all of which have a substantial impact on their overall quality of life [9, 10]. Symptom clusters refer to a collection of multiple related symptoms that arise during disease treatment due to treatment modalities or other associated factors [11]. During the treatment process of radical mastectomy and breast reconstruction for breast cancer, patients often encounter a range of symptom clusters. These clusters not only heighten their physical distress but also significantly affect their mental and social well-being [12].

This study aims to longitudinally track symptom clusters in patients undergoing breast reconstruction surgery following breast cancer, explore their dynamic changes, and provide more precise symptom management strategies for clinical

practice. The findings are reported as follows.

2. Objects and methods

2.1 Study subjects

Using a convenience sampling method, a retrospective study was conducted on 120 patients who underwent breast reconstruction surgery for breast cancer at our hospital from January 2021 to October 2023. While the research was conducted in a retrospective manner, we systematically performed follow-up assessments and collected data at designated postoperative time intervals (T2–T7). This methodology enabled us to continuously observe and manage symptom clusters over time, ensuring the uniformity and comprehensiveness of data across various time points.

Inclusion criteria: (1) Age $\geq$18 years old. (2) Diagnosed with breast cancer confirmed by ultrasound, Computed Tomography (CT), magnetic resonance imaging (MRI), and histopathological examination, and meeting the criteria of the "Chinese Anti-Cancer Association Breast Cancer Diagnosis and Treatment Guidelines and Norms" [13]. (3) Patients underwent radical mastectomy for breast cancer followed by breast reconstruction surgery. (4) Capable of completing multiple follow-ups and symptom assessments. (5) Patients and their spouses were aware of the study's content and significance, and signed informed consent forms.

Exclusion criteria: (1) Severe diseases affecting important organs such as heart, liver, or kidneys, or other conditions unsuitable for surgery. (2) Patients with severe mental illness or cognitive impairment unable to cooperate with the study. (3) Terminally ill patients with an expected survival period of less than 3 months.

2.2 Research methods

2.2.1 Sample size calculation

The purpose of this study is to longitudinally track changes in symptom clusters among patients after breast reconstruction surgery following breast cancer and investigate their dynamic patterns of change. Therefore, systematic assessments of patients are required at multiple time points (admission, postoperative day 1, week 1, month 1, month 3, month 6 and month 12). Adequate sample sizes are essential at each time point to ensure the continuity of data and the completeness of follow-up. Referring to relevant literature and previous studies [2], sample sizes exceeding 100 cases are required to achieve statistically significant results. To calculate sample size, statistical software like G*Power (3.1, G*Power company, Dusseldorf, NW, Germany) was used, with a moderate effect size (0.3), α level of 0.05, and power of 0.80. This resulted in approximately ninety cases per group. Given a 20% attrition rate, this study had 120 study participants.

2.2.2 Research tools

2.2.2.1 General information

A self-designed general information questionnaire was used to collect basic information from breast cancer patients, including age, marital status, education level, occupation, economic status, body mass index (BMI), medical history, family history, social support, as well as disease-related data such as pathological type, course of disease, clinical stage, tumor metastasis status, type of surgery, type of reconstruction surgery and presence of comorbidities.

2.2.2.2 Chinese version of the memorial symptom assessment scale

The Chinese iteration of the Memorial Symptom Assessment Scale (MSAS) [14] comprises 32 items designed to evaluate the prevalence, frequency, intensity and level of discomfort of symptoms encountered by patients over the previous week. Among these, 24 items evaluate the occurrence rate, frequency, severity and distress caused by symptoms related to the disease and treatment, while the remaining 8 items assess only severity and distress levels. The occurrence rate is calculated as "yes" or "no"; frequency and severity are rated on a 4-point scale from 1 to 4, indicating "rarely" to "almost always"/"mild" to "very severe"; distress level is rated on a 5-point Likert scale from 0 to 4, indicating "not at all" to "very much". A greater symptom score signifies that the patient has experienced symptoms with increased frequency, severity and distress. The Chinese version of the Memorial Symptom Assessment Scale demonstrates a content validity of 0.94 and a Cronbach's α coefficient of 0.87.

2.2.3 Data collection and quality control

2.2.3.1 Data collection

This study obtained approval from the Hospital's Ethics Committee. Data collection was conducted using a self-designed general information questionnaire and the Chinese version of the Memorial Symptom Assessment Scale (MSAS). The basic patient information and disease-related data were gathered through the general information questionnaire, whereas the MSAS was employed to evaluate the symptom experiences of the patients. Data collection time points included: admission (T1), 1-day post-reconstruction surgery (T2), 1-week post-reconstruction surgery (T3), 1-month post-reconstruction surgery (T4), 3 months post-reconstruction surgery (T5), 6 months post-reconstruction surgery (T6) and 12 months post-reconstruction surgery (T7). In our analysis, symptoms like "fatigue" were categorized within the "somatic dysfunction" cluster because they demonstrated a higher degree of association with this factor. Conversely, symptoms such as "oral ulcer" and "itchy skin" were placed in the "neurological and sensory symptom cluster" instead of being grouped with "sleep-related symptoms", as the factor loadings suggested a stronger correlation with neurological functions.

Data collection methods were as follows:

At admission (T1): general information and basic medical data were collected through face-to-face interviews conducted by professional medical staff.

Follow-up post-surgery (T2–T7): trained medical professionals conducted telephone or face-to-face interviews to gather symptom assessment data and relevant information.

2.2.3.2 Quality control

During the study design phase, a detailed research protocol was established to define the research objectives, subjects, methods and analysis plans. To ensure the reliability and validity

of the research, appropriate survey instruments such as the general information questionnaire and MSAS were carefully developed.

Personnel training: Consistent and accurate data collection was ensured through the provision of standardized training to medical personnel participating in data collection activities. This training encompassed the utilization of survey instruments, various data collection approaches and effective interviewing strategies. Training also included ethical principles to ensure patient informed consent and privacy protection.

Data collection process: In order to maintain consistency in data collection, each interview was carried out by the identical medical staff member, thereby reducing the potential influence of personnel changes. Strict adherence to the questionnaire design during data collection was maintained to avoid omissions or errors.

Data entry and management: The collected data was swiftly inputted into an electronic database, with a careful process of double-checking during the data entry phase to guarantee accuracy. A data backup mechanism was established to regularly back up data and prevent data loss.

Follow-up management: A comprehensive follow-up strategy was devised to guarantee timely follow-up for all patients. A reminder system was established to prompt patients through phone calls or text messages for their scheduled follow-up appointments. In cases where patients were lost to follow-up, various contact methods were utilized extensively to locate them and secure the integrity of follow-up data.

2.2.4 Statistical methods

Statistical analysis was performed using SPSS 25.0 software (SPSS software company, Chicago, IL, USA). Descriptive statistical analysis was conducted on patients' demographic data and disease-related information, including frequency and percentage. Descriptive statistical analysis was also performed on symptom scores at different time points (T1–T7). Exploratory Factor Analysis (EFA) was used to extract symptom clusters at each time points, employing either Principal Component Analysis or Maximum Variance Method for factor extraction to identify symptom clusters. The applicability of factor analysis was determined based on Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity.

3. Results

3.1 General information

The general information of 120 patients is as follows, refer to Table 1.

3.2 Symptoms of breast cancer after breast reconstruction

Symptom occurrence rates are relatively high at postoperative week 1 (T3) and postoperative day 1 (T2), primarily concentrated in aspects such as pain, fatigue, poor sleep, nausea, dry mouth and anxiety. As time advanced to postoperative month 1 (T4), postoperative month 3 (T5), postoperative month 6 (T6) and postoperative month 12 (T7), the frequencies of most symptoms showed a gradual decline. Nonetheless, fatigue, disrupted sleep and feelings of anxiety persisted as prevalent symptoms. Refer to Table 2 for details.

3.3 Characteristics of symptom group changes at various time points in patients post breast cancer reconstruction surgery

At T3, the number of symptoms with an incidence greater than 20% was highest. Therefore, a factor analysis was conducted on all symptoms at T3, using principal component analysis to extract common factors, followed by rotation with the varimax method to finalize the symptom clusters. Six principal components were identified through the selection criteria of eigenvalues greater than or equal to 1 and the scree plot criterion, contributing to a combined variance of 54.446%. Subsequently, a factor loading threshold of >0.4 was applied post-rotation to group symptoms into six distinct clusters, which were labeled in Table 3 following clinical insights.

4. Discussion

4.1 Symptom experience at different time points in patients after breast reconstruction surgery for breast cancer

A longitudinal study of symptom clusters in patients undergoing breast reconstruction surgery for breast cancer finds that symptoms are most prominent between postoperative week 1 (T3) and postoperative day 1 (T2), with an emphasis on pain, exhaustion, poor sleep, nausea, dry mouth and anxiety. This finding is consistent with previous research [15], which identified the early postoperative period as crucial for symptom control. During this stage, patients experience a range of symptoms as a result of significant physical and psychological changes brought on by surgical trauma, anesthesia-related side effects, and the recovery process [16]. The main source of pain in the early postoperative period is typically the result of surgical wounds and tissue injuries. Fatigue, on the other hand, is a common reaction to surgical trauma, and disturbances in sleep patterns could be associated with both pain and psychological stress [17].

As time progresses to postoperative month 1 (T4), month 3 (T5), month 6 (T6) and month 12 (T7), the occurrence rates of most symptoms gradually decrease, indicating that patients' bodies are gradually adapting to postoperative conditions and recovery processes are advancing. Nevertheless, fatigue, inadequate sleep and anxiety continue to be prevalent symptoms [18]. Persistent sleep problems are a result of continued psychological stress and physical discomfort, as anxiety relates to worries about disease recurrence and unease regarding alterations in body image [19]. This study suggests that nursing staff should conduct comprehensive dynamic assessments of patients after breast cancer radical mastectomy and breast reconstruction surgery, and promptly adjust nursing plans to alleviate patients' symptom burdens.

During the preoperative stage, nursing staff should provide sufficient health education and psychological counseling to help patients develop positive recovery beliefs. During the initial phase after surgery, it is crucial to offer adequate pain control, ensure comfort, and provide emotional assistance to

TABLE 1. The general information of the patients (n = 120, n%).

Item	Category	Number of cases	Percentage
Age (yr)			
	18–40	21	17.50%
	40–49	34	28.33%
	50–59	43	35.83%
	≥60	22	18.33%
Marital status			
	Married	78	65.00%
	Unmarried	19	15.83%
	Divorced/Widowed	23	19.17%
Education level			
	Elementary school and below	9	7.50%
	Junior high school	31	25.83%
	High school/Technical secondary school	41	34.17%
	College degree and above	39	32.50%
Occupation			
	Employed	51	42.50%
	Self-employed	29	24.17%
	Retired	19	15.83%
	Other	21	17.50%
Economic status (in yuan)			
	<5000	39	32.50%
	5000–8000	62	51.67%
	>8000	19	15.83%
Body Mass Index (BMI)			
	Normal	69	57.50%
	Overweight	32	26.67%
	Obesity	19	15.83%
Duration of illness (yr)			
	<1	31	25.83%
	1–3	59	49.17%
	>3	30	25.00%
Cancer staging			
	Stage I	39	32.50%
	Stage II	52	43.33%
	Stage III	29	24.17%
Pathological type			
	Invasive ductal carcinoma	79	65.83%
	Invasive lobular carcinoma	21	17.50%
	Other types	20	16.67%
Medical history/Past medical history			
	Surgery	120	100.00%
	Chemotherapy	99	82.50%
	Radiotherapy	81	67.50%
	Endocrine therapy	62	51.67%

TABLE 1. Continued.

Item	Category	Number of cases	Percentage
Family history			
	Yes	28	23.33%
	No	92	76.67%
Comorbidities			
	Diabetes	21	17.50%
	Hypertension (High blood pressure)	31	25.83%
	Other	22	18.33%
	None	46	38.33%
Type of surgery			
	Mastectomy (removal of the breast)	71	59.17%
	Breast-conserving surgery (also known as lumpectomy or partial mastectomy)	49	40.83%
Type of reconstruction surgery			
	Breast implantation (implantation of a prosthesis)	79	65.83%
	Flap reconstruction (tissue flap transplantation)	41	34.17%
Social support			
	High	59	49.17%
	Moderate	43	35.83%
	Low	18	15.00%
Surgical complications			
	Yes	29	24.17%
	No	91	75.83%

alleviate immediate symptoms [20]. In the process of recuperation, it is important to focus on the long-term management of symptoms, especially addressing ongoing issues such as fatigue, sleep disturbances and psychological challenges. This involves helping patients through rehabilitation training for functional recovery and offering essential psychological assistance, support and counseling [21]. In the future, similar tools should be fully utilized in clinical practice for comprehensive assessment and management of patient symptoms, enhancing the specificity and effectiveness of nursing care. Through comprehensive symptom management strategies, patients' symptom burdens can be better alleviated, overall quality of life can be improved, and physical and mental recovery can be promoted.

4.2 Symptom clusters at different time points in patients after breast reconstruction surgery for breast cancer

This study utilized exploratory factor analysis to identify 6 distinct symptom clusters. Due to the highest symptom occurrence rate at T3, factor analysis was based on all symptoms observed at T3. Principal component analysis was employed to extract these factors. The cluster of psychological symptoms comprises feelings of anxiety, discomfort and unhappiness, which mirror the emotional strain experienced by patients throughout surgical procedures and treatment protocols [19]. These symptoms are often associated with the psychological pressure of surgical trauma and postoperative recovery periods. Patients facing uncertainty after disease and surgery are prone to anxiety and sadness. The existence of adverse feelings and lack of attention can intensify symptom awareness and impede patient recuperation [18]. The cluster of symptoms related to fatigue primarily includes tiredness and physical exhaustion, which are closely associated with the physical depletion and recovery phase following surgery [22]. Physical trauma during surgery and treatment, as well as inadequate nutrition intake and limited activity postoperatively, contribute to fatigue and decreased physical strength [23]. The cluster of gastrointestinal symptoms comprises of nausea, vomiting and decreased appetite. These symptoms are linked to stress responses following surgery, side effects of anesthesia, and dietary modifications post operation [24]. The impact of surgery and treatment on the digestive system, along with changes in postoperative diet, leads to the onset of these symptoms [25]. The cluster of symptoms related to the mouth and skin includes dryness in the oral cavity and skin problems, primarily triggered by the impact of surgery and radiation [26]. The Neurological and Sensory Symptoms Cluster encompasses numbness and tingling sensations, often related to the impact of surgery and related treatments on the nervous system [27]. Nerve damage caused by surgical trauma and radiation can result in sensations of numbness and tingling, leading to discomfort [28]. Pain not only affects physical recovery but may also lead to psychological stress and sleep disorders [20]. The cluster of symptoms related to sleep mainly consists of disruptions in sleep patterns and other sleep-

TABLE 2. Symptom incidence in patients undergoing breast cancer reconstruction surgery (n = 111).

Items	T1	T2	T3	T4	T5	T6	T7
Fatigue	70 (58.33%)	105 (90.52%)	99 (89.19%)	94 (90.38%)	74 (88.10%)	65 (85.53%)	55 (85.94%)
Pain	0 (0.00%)	110 (94.83%)	104 (93.69%)	83 (79.81%)	60 (71.43%)	45 (59.21%)	16 (25.00%)
Poor sleep	85 (70.83%)	100 (86.21%)	95 (85.59%)	89 (85.58%)	69 (82.14%)	60 (78.95%)	50 (78.13%)
Anxiety	100 (83.33%)	56 (48.28%)	90 (81.08%)	78 (75.00%)	64 (76.19%)	54 (71.05%)	45 (70.31%)
Mental stress	91 (75.83%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Feelings of sadness	79 (65.83%)	60 (51.72%)	69 (62.16%)	64 (61.54%)	40 (47.62%)	40 (52.63%)	35 (54.69%)
Irritability	74 (61.67%)	45 (38.79%)	54 (48.65%)	55 (52.88%)	35 (41.67%)	25 (32.89%)	30 (46.88%)
Dry mouth	66 (55.00%)	89 (76.72%)	79 (71.17%)	69 (66.35%)	45 (53.57%)	30 (39.47%)	20 (31.25%)
Constipation	29 (24.17%)	71 (61.21%)	84 (75.68%)	73 (70.19%)	49 (58.33%)	35 (46.05%)	25 (39.06%)
Nausea	0 (0.00%)	95 (81.90%)	75 (67.57%)	59 (56.73%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Sweating	60 (50.00%)	85 (73.28%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Feeling not like oneself	44 (36.67%)	50 (43.10%)	49 (44.14%)	44 (42.31%)	54 (64.29%)	49 (64.47%)	40 (62.50%)
Dizziness	39 (32.50%)	79 (68.10%)	65 (58.56%)	39 (37.50%)	24 (28.57%)	20 (26.32%)	10 (15.63%)
Drowsiness	34 (28.33%)	74 (63.79%)	26 (23.42%)	19 (18.27%)	14 (16.67%)	10 (13.16%)	10 (15.63%)
Difficulty with bowel movements/urination	24 (20.00%)	64 (55.17%)	59 (53.15%)	49 (47.12%)	29 (34.52%)	20 (26.32%)	10 (15.63%)
Loss of appetite	54 (45.00%)	21 (22.41%)	30 (27.03%)	21 (20.19%)	15 (17.86%)	10 (13.16%)	10 (15.63%)
Decreased body weight	49 (40.83%)	30 (25.86%)	34 (30.63%)	25 (24.04%)	15 (17.86%)	10 (13.16%)	10 (15.63%)
Feeling of body swelling/abdominal bloating	21 (17.50%)	39 (33.62%)	43 (38.74%)	35 (33.65%)	24 (28.57%)	16 (21.05%)	10 (15.63%)
Numbness in hands/feet	14 (11.67%)	34 (29.31%)	38 (34.23%)	29 (27.88%)	20 (23.81%)	15 (19.74%)	10 (15.63%)
Difficulty concentrating	12 (10.00%)	21 (18.10%)	21 (18.92%)	14 (13.46%)	10 (11.90%)	10 (13.16%)	10 (15.63%)
Skin itching	10 (8.33%)	19 (16.38%)	19 (17.12%)	13 (12.50%)	9 (10.71%)	10 (13.16%)	10 (15.63%)
Changes in skin	9 (7.50%)	15 (12.93%)	14 (12.61%)	9 (8.65%)	9 (10.71%)	6 (7.89%)	5 (7.81%)
Oral ulcers	8 (6.67%)	13 (11.21%)	13 (11.71%)	8 (7.69%)	8 (9.52%)	5 (6.58%)	5 (7.81%)
Hair loss	7 (5.80%)	9 (7.76%)	9 (8.11%)	6 (5.77%)	7 (8.33%)	5 (6.58%)	5 (7.81%)

TABLE 3. Symptom factor analysis in patients undergoing breast cancer reconstruction surgery (n = 111).

Symptom Cluster	Symptom	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Autonomic nervous dysfunction symptom cluster							
	Dry mouth	0.806					
	Nausea	0.875					
	Sweating	0.692					
	Anxiety	−0.447					
Fatigue symptom cluster							
	Drowsiness		0.617				
	Weight loss		0.605				
	Loss of appetite		0.503				
	Feeling of body swelling/abdominal		0.466				
	Irritability		−0.451				
Somatic dysfunction symptom clusters							
	Dizziness			−0.668			
	Pain			−0.557			
	Constipation			−0.546			
Psychological dysfunction symptom clusters							
	Sadness				0.631		
	Feeling unlike oneself				−0.595		
	Difficulty with bowel movements/urination				0.587		
	Fatigue				0.528		
Neurological and sensory symptom clusters							
	Difficulty concentrating					0.748	
	Numbness in hands/feet					0.605	
Sleep-related symptom clusters							
	Itchy Skin						0.590
	Oral ulcer						−0.554
	Poor sleep						0.443

related challenges, which are linked to physical discomfort and psychological stress in the postoperative recovery phase [19, 22]. By integrating clinical practice to foresee patient-related symptoms, proactive assessment enhances synergistic symptom management and improves management efficiency [29].

In addition, the timing of breast reconstruction, whether immediate or delayed, may influence postoperative symptoms and recovery. Immediate reconstruction has the potential to speed up psychological healing but also carries the risk of higher early postoperative complications. On the other hand, delayed reconstruction allows for a more gradual recovery process. Future studies should explore how these timing differences affect symptom clusters to optimize care. Moreover, the recovery process following prosthetic or autologous reconstructions may vary, as prosthetic reconstruction tends to lead to a speedier recovery time, albeit with increased risks associated with implants. Future studies should assess how these methods affect symptom clusters to improve patient care. Distinct postoperative symptom burdens may arise from total and partial mastectomies, as total mastectomy typically necessitates more comprehensive recovery requirements.

5. Conclusions

This study observed symptom clusters longitudinally in patients after breast reconstruction surgery following breast cancer. It found that postoperative week 1 (T3) and postoperative day 1 (T2) were periods of high symptom occurrence. Pain, fatigue, poor sleep, nausea, dry mouth and anxiety were identified as the primary symptoms. The key symptoms within these groupings showed a consistent stability over the duration of the study. It is crucial for nursing personnel to continually evaluate and enhance the integrated care for these symptom groupings. Nevertheless, this research is subject to certain constraints. The somewhat limited sample size restricts the generalizability and comprehensiveness of the findings. Additionally, the study relied mainly on self-reported symptom data from patients, which may introduce subjective biases. In the future, it is recommended that studies expand their sam-

ple sizes to improve the generalizability and applicability of findings. Additionally, utilizing a multi-site research approach would enhance the range of data collected and the credibility of results. Furthermore, combining objective physiological markers with patient-reported outcomes would offer a more holistic evaluation of symptoms. These improvements could further enhance symptom management for patients after breast reconstruction surgery for breast cancer, improve their quality of life and recovery outcomes.

AVAILABILITY OF DATA AND MATERIALS

The authors declare that all data supporting the findings of this study are available within the paper and any raw data can be obtained from the corresponding author upon request.

AUTHOR CONTRIBUTIONS

SFH and YPY—designed the study and carried them out; supervised the data collection; analyzed the data; interpreted the data; prepared the manuscript for publication and reviewed the draft of the manuscript. Both of authors have read and approved the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Ethics Committee of Shengzhou People's Hospital (Shengzhou Branch of the First Affiliated Hospital of Zhejiang University School of Medicine) (2021-002-01). Written informed consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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