ORIGINAL RESEARCH

Influence of continuous nursing model based on network on the postoperative mental status and quality of life of breast cancer patients

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Abstract

This study investigates the impact of continuous nursing based on a network model on breast cancer care and its effects on the mental well-being and quality of life of postoperative patients. Seventy breast cancer patients were randomly divided into two groups: the conventional care group (received standard care after breast cancer surgery) and the observation group (received continuous nursing based on the network model in addition to standard care). Their mental status, quality of life, nursing satisfaction, compliance and postoperative complications were assessed before enrollment and six months after intervention. The results showed that after six months of intervention, the observation group had significantly lower scores on the Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS) compared to the conventional care group. Furthermore, the observation group had significant improvements in five quality of life domains—physiological status, social/familial circumstances, emotional well-being, functional capacity and additional concerns—compared to the conventional care group. Nursing satisfaction (91.43% *vs.* 68.57%) and treatment compliance (97.14% *vs.* 85.71%) were also substantially higher in the observation group, while the incidence of postoperative adverse reactions was significantly lower (22.86% *vs.* 48.57%), indicating statistical significance compared to the conventional care group ($p < 0.05$). In conclusion, the network-based continuous nursing model could be a safe and effective approach to effectively enhance the mental well-being and quality of life of postoperative breast cancer patients while also improving nursing satisfaction and treatment compliance and reducing the occurrence of postoperative adverse reactions.

Keywords

Breast cancer; Network-based continuous nursing; Mental state; Quality of life; Postoperative application

1. Introduction

Cancer reports from the National Cancer Center in 2022 reveal that breast cancer has the highest incidence among Chinese females, with increasing morbidity and mortality rates [1], and previous investigations have indicated that individuals aged 45 to 55 have increased risks of breast cancer. However, there has been a shift in this trend in China in recent years due to changes in lifestyle and increased stress levels, leading to the age of breast cancer diagnosis showing a decreasing trend, with a corresponding annual increase in the proportion of young women diagnosed with breast cancer [2, 3].

Clinical studies on breast cancer reveal that the five-year survival rate in China reaches 82%, a figure significantly lower than that of developed countries (90.9%), potentially attributed to delayed cancer diagnosis, late treatment initiation and inconsistent care practices [4, 5]. Presently, surgery remains the cornerstone of breast cancer treatment. However, postopera-

tive patients often encounter challenges in self-rehabilitation nursing. Factors such as body image alterations due to breast loss and adjustments in daily life roles can lead to negative emotions and diminished quality of life [6, 7]. Therefore, it is imperative to explore services that offer comprehensive postoperative rehabilitation support to enhance overall quality of life.

Introduced to China in 2001, continuous nursing was initially proposed by foreign scholars. This clinical nursing model integrates telephone follow-up and home visits. It has been suggested that continuous nursing effectively enhances patient satisfaction and alleviates adverse psychological outcomes [8, 9]. However, recent studies have revealed a high rate of loss to follow-up associated with telephone follow-up, limiting the widespread adoption of continuous nursing [10]. Recognizing the prevalence of WeChat (3.9312.17, Shenzhen Tencent computer system Co., Ltd., Shenzhen, Guangdong, China), a popular social software, among the public, our hospi-

tal has implemented knowledge dissemination, rehabilitation nursing interventions and information feedback through the WeChat platform. These activities are facilitated through communication channels such as WeChat official accounts and WeChat groups for patients. Herein, we designed this present study to investigate the nursing effects of a network-based continuous nursing model following breast cancer surgery.

1.1 Study object and methods

From January 2020 to February 2022, breast cancer patients who were diagnosed and treated at our hospital were selected for this study. The inclusion criteria were (1) women diagnosed with breast cancer confirmed by pathology and undergoing radical mastectomy for the first time, (2) possessed smartphones and could independently complete the questionnaire with high compliance and no communication barriers, and (3) provided complete clinical data and voluntary signing of the informed consent form. The exclusion criteria were patients with severe organ dysfunction other than breast cancer or infectious diseases, those who failed to complete follow-up as per the protocol, pregnant women, and patients with cancer recurrence or distant metastasis. In the current study, 70 patients who met the criteria were randomly divided into two groups (conventional nursing group and observation group) using a random sampling method. The general baseline data of all subjects are presented in Table 1. The study was conducted following approval from the Ethics Committee of Xi'an Ninth Hospital (Approval no. 202323).

The sample size was determined based on the quality of life of the two groups of patients after the intervention, using the sample size formula for comparing the means of two samples: $n = 2 [(Z_{\alpha/2} + Z_{\beta})/(\delta/\sigma)]^2$. Here, n represents the required sample size for each group, δ denotes the overall difference, and σ signifies the overall standard deviation. With α set at 0.05 and β at 0.10, and using $Z_{0.05/2} = 1.96$ and $Z_{0.10} = 1.28$, δ was assumed to be 2 and σ as 2.9. By substituting these values into the formula, n was calculated to be 30. Considering potential loss to follow-up or withdrawal from the trial, the sample size was increased by 15% from the original calculation, resulting in a requirement of 35 cases in each group, for a total of 70 cases.

1.2 Nursing methods

All 35 patients in the routine nursing group received standard postoperative care following breast cancer surgery, which included (1) dietary guidance: emphasis placed on strengthening nutrition to enhance body resistance and promote wound healing; (2) exercise guidance: instructions to continue functional exercises, such as raising the affected limb (flexing and extending the affected elbow joint to the level of the shoulder), climbing the wall with fingers (gradually increasing height), and combing the hair (using the affected hand to comb the contralateral hair), with a frequency of 3–4 times a day for 10–20 minutes each session, as appropriate; (3) limb maintenance procedures: patients were advised to avoid nursing operations on the affected limb, refrain from excessive movement, lifting heavy objects or activities that may cause trauma, as well as to wear loose and comfortable clothing. They were also instructed not to wear watches, jewelry, or other accessories on the affected limb; (4) regular breast examination: they were encouraged to perform self-examinations of the breast once a month, preferably 2–3 days after the end of menstruation for premenopausal women, and on a fixed day for menopausal women; and (5) follow-up guidance: they were informed that the researcher would conduct regular telephone follow-ups and outpatient visits once a month for three months post-discharge to assess functional recovery of the affected limb and provide relevant health guidance.

Patients in the observation group received the network-based continuous nursing model, building upon the nursing model utilized in the conventional care group, primarily through nursing interventions via the WeChat platform on

TABLE 1. General baseline data of the 70 breast cancer patients assessed.

Variables	Conventional care group (n = 35)	Observation group (n = 35)	t/χ^2 value	p value
Age	43.91 ± 6.59	45.17 ± 7.85	0.730	0.468
Married/divorced	31/4	29/6	0.467	0.495
Surgical method				
Modified radical mastectomy	25	27		
Breast-conserving surgery	3	2	0.354	0.838
Simple mastectomy	7	6		
TNM staging				
Stage II	22	17	1.447	0.229
Stage III	13	18		
Degree of education				
Junior middle school	5	4		
Senior middle school	8	6	0.588	0.745
Bachelor's degree or above	12	15		

TNM: Tumor Node Metastasis.

their cell phones. The main components of this intervention included: (1) Formation of the continuous nursing group: this group comprised three breast surgeons primarily responsible for developing daily rehabilitation intervention measures and troubleshooting, along with five professional nursing staff members primarily responsible for managing the normal operation of the WeChat platform, releasing and overseeing intervention measures, developing group meetings, and compiling and analyzing feedback information. All members possessed extensive experience and excellent communication and education abilities. Regular professional training, group reporting, and summaries were conducted after the group's establishment. Timely feedback was provided for any issues encountered during this stage, which were promptly addressed. (2) Development of continuous nursing: using the patients' reserved telephone numbers, hospital medical staff established WeChat groups managed by medical personnel, with clear group rules stipulated. To ensure uninterrupted rest, the group's designated silent period was from 10:00 PM to 7:00 AM the following day. Upon the WeChat group formation, indicated nursing staff disseminated breast cancer-related knowledge covering disease development, influencing factors, treatment options, postoperative self-care, and rehabilitation training through easily understandable documents, pictures or videos. In addition, tailored daily rehabilitation plans were devised based on individual patient recovery statuses, with patients supervised or prompted by their families. Training feedback was facilitated through recorded videos, which were then summarized and reviewed by nursing staff. Psychological state and quality of life assessments were regularly conducted via questionnaires issued on the WeChat official account. Patients experiencing adverse emotions such as anxiety and depression received targeted communication. Periodically, emotive prose and videos were shared in the group, and a monthly postoperative breast cancer rehabilitation exchange meeting was scheduled for the last week of each month, with hospital nursing staff guiding patient participation. The meeting primarily involved discussions on postoperative rehabilitation experiences, collective problem-solving and proposing solutions. Through doctor-patient communication, the focus was not only on addressing queries but also on regulating or improving patients' psychological states and promptly addressing negative emotions, thereby fostering a sense of care from both family and medical professionals. After each meeting, professional nursing staff summarized the discussions for reference within the group. (3) Collection of continuous nursing information: information was primarily collected through group questionnaires, with self-assessment forms available in the group files. Regular questionnaire surveys were conducted, and the collected data were statistically analyzed and summarized.

1.3 Study content

The mental state, quality of life, nursing satisfaction, compliance and postoperative complications of the patients were assessed both before enrollment and six months after intervention.

1.3.1 Assessment of mental state

The Self-rating Anxiety Scale (SAS) and Self-rating Depression Scale (SDS) were utilized to assess anxiety and depression among the study participants, respectively. Both scales consist of 20 items each, using a four-level scoring method ranging from 1 to 4 points. Scores were assigned based on the frequency of symptoms experienced by patients, where a score of 1 indicates symptoms do not appear or rarely appear, 2 denotes occasional occurrence, 3 signifies frequent occurrence and 4 represents persistent or constant presence of symptoms. The percentage system calculation method was used for both scales. The total score of the 20 items was tallied, with symptom severity corresponding to the score. Anxiety levels were categorized based on a cut-off score of 50, where scores below this threshold indicate the absence of anxiety (normal group). In addition, scores ranging from 50 to 60 indicate mild anxiety, 61 to 70 suggest moderate anxiety and scores exceeding 70 indicate severe anxiety. Depression was categorized based on a cut-off value of 53, where scores from 53 to 62 indicate mild depression, 63 to 72 suggest moderate depression and scores higher than 72 indicate severe depression. Of note, some items in the depression scale were reverse-scored during calculation, and clear scoring criteria were applied accordingly.

1.3.2 Quality of life assessment

The Functional Assessment of Cancer Therapy (FACT) scale [11] was used to assess the quality of life of patients. This scale consists of 27 items measuring various aspects of quality of life, including physical well-being (7 items), social/family relationships (7 items), emotional well-being (6 items), functional well-being (7 items) and 9 additional items addressing specific concerns related to breast cancer symptoms. Each of the 36 items is scored on a five-level scale ranging from 0 to 4 points, with responses ranging from "not at all" (scored as 0) to "very much" (scored as 4). The total score is then calculated, with higher scores indicating better quality of life among breast cancer patients.

1.3.3 Nursing satisfaction

A self-developed nursing satisfaction questionnaire specific to breast cancer patients was utilized to assess satisfaction levels through a questionnaire survey. The satisfaction rate (%) was calculated using the formula: Satisfaction rate (%) = (satisfactory cases + basically satisfactory cases)/overall cases × 100%.

1.3.4 Compliance

The compliance of patients was assessed six months after surgery [12]. Patients who actively completed the rehabilitation training program were categorized as demonstrating full compliance. Those who actively implemented part of the training program and required supervision from family members or medical staff were classified as showing partial compliance. Patients who were unable to complete the rehabilitation training program were classified as non-compliant. The overall compliance rate (%) was calculated using the formula: Overall compliance rate (%) = (overall cases-non-compliance cases)/overall cases × 100%.

1.3.5 Investigation on postoperative complications of subcutaneous hydrops and lymphedema

Six months after surgery, patients were followed up and examined for the occurrence of complications such as subcutaneous hydrops and lymphedema. The severity of edema was also assessed during this investigation. Pitting edema in the upper limbs was categorized as stage I if the edema disappeared upon elevation of the upper limbs. Stage II was characterized by the persistence of edema even with elevated upper limbs, accompanied by moderate fibrosis and stage III was identified by the presence of rubbery swelling in the upper limbs [13].

1.4 Statistical methods

The raw data were compiled and analyzed using Statistical Product and Service Solutions (SPSS, IBM Corp., Armonk, NY, USA) version 23.0. For measurement data with consistent sample means, such as mental status and quality of life scores, the independent sample t-test was employed. The chi-square test was utilized to compare data involving number statistics. $p < 0.05$ was considered statistically significant.

2. Results

2.1 Mental state comparison between groups

The SAS and SDS scores of the 70 patients before and after the intervention are shown in Table 2. The results showed that before intervention, there were no significant differences in scores between the groups ($t = 1.053$, 1.684, $p = 0.296$, 0.097). However, after the intervention, the scores within each group significantly decreased compared to scores before the intervention. Importantly, the reduction in scores was more pronounced in the study group compared to the conventional care group ($p < 0.05$).

2.2 Quality of life comparison between groups

The individual quality of life scores for the 70 breast cancer patients before and after the intervention are detailed in Table 3. Prior to the intervention, there were no significant differences in the quality of life scores between the groups ($t = 0.423$, 0.985, 0.461, 1.064, 0.156, $p = 0.674$, 0.328, 0.646, 0.291, 0.876). However, following the intervention, both groups exhibited an increase in scores compared to their respective scores before the intervention. Notably, the quality of life scores after the intervention in the study group were significantly higher than those in the control group ($p < 0.05$).

2.3 Nursing satisfaction comparison

The nursing satisfaction rate in the observation group was 91.43%, which was significantly higher than the rate of 68.57% in the conventional care group (χ^2 value = 8.835, $p = 0.012$). The detailed results are shown in Table 4.

2.4 Postoperative compliance survey

Among the 35 patients in the routine care group, 5 patients were non-compliant, while 11 patients were fully compliant, resulting in a total compliance rate of 85.71%. In contrast, in the observation group, only 1 patient was non-compliant, while 22 patients were fully compliant, yielding a total compliance rate of 97.14%. Comparative analysis showed that this rate was significantly higher than that observed in the conventional care group (χ^2 value = 7.914, $p = 0.019$) (Table 5).

2.5 Investigation on postoperative complications of subcutaneous hydrops and lymphedema

In the postoperative conventional care group, 5 patients developed subcutaneous hydrops and 12 patients experienced lymphedema. Among them, 6 patients were classified as stage I, 4 patients as stage II and 2 patients as stage III. The total incidence of adverse events was 48.57%. Comparatively, the observation group had 2 patients with subcutaneous hydrops and 6 patients with lymphedema, with 4 patients classified as stage I, 2 patients as stage II and no patients classified as stage III. The overall adverse reaction rate was significantly lower than that in the conventional care group (χ^2 value = 5.040, $p = 0.025$).

3. Discussion

The pathogenesis of breast cancer is complex. Apart from genetic factors and gene mutations, lifestyle habits such as high-fat diets and alcohol consumption have been shown to demonstrate varying impacts. Particularly in recent years, the grim situation of the novel coronavirus (COVID-19) pandemic in China has disrupted and even halted cancer screening programs in some instances. Studies have shown a decrease in early breast cancer incidence and a notable increase in late-stage cases since the onset of the COVID-19 epidemic [14, 15]. Moreover, static management measures have been implemented in diverse regions due to the epidemic, resulting in challenges for breast cancer patients to undergo immediate operations or complete postoperative adjuvant therapy and follow-up. Various factors significantly affect the therapeutic outcomes of breast cancer [16]. Surgical interventions and chemoradiotherapy remain the primary treatment modalities for breast cancer. However, the diagnostic process, life stressors and side effects of postoperative chemotherapy drugs can diminish patients' quality of life [17–19]. In recent years, various postoperative care regimens for breast cancer have been proposed clinically, achieving varying degrees of success [20–22]. Among these, continuous nursing stands out as one regimen that prominently facilitates postoperative rehabilitation and improves the quality of life [23–25]. As previously mentioned, the inherent limitations of telephone follow-up interventions, compounded by the unique challenges posed by the epidemic, limited the effectiveness of this nursing approach.

Continuous nursing represents a significant advancement in traditional nursing practices by integrating nursing models and methods into patients' daily routines, thereby offering

T A B L E 2. Mental status comparison between groups ($\bar{x} \pm s$).

Group	Case	Time	SAS (Score)	SDS (Score)
Conventional care group	35	Pre-intervention	62.94 ± 6.59	62.17 ± 7.04
		Post-intervention	49.06 ± 5.63	48.86 ± 5.31
Observation group	35	Pre-intervention	64.73 ± 7.60	64.57 ± 4.59
		Post-intervention	38.23 ± 4.37	36.42 ± 4.10
t value			8.988	10.973
p value			<0.001	<0.001

SAS: Self-Rating Anxiety Scale; SDS: Self-Rating Depression Scale.

T A B L E 3. Quality of life comparison between groups ($\bar{x} \pm s$).

Group	Case	Time	Physiological state	Social/family condition	Emotional well-being	Functional status	Additional concerns
Conventional care group	35	Pre-intervention	12.95 ± 1.83	15.16 ± 1.49	12.85 ± 1.48	11.35 ± 2.54	16.37 ± 1.93
		Post-intervention	16.00 ± 1.41	17.71 ± 1.49	15.72 ± 1.62	15.06 ± 2.03	20.94 ± 2.56
Observation group	35	Pre-intervention	12.78 ± 1.49	15.52 ± 1.56	13.00 ± 1.07	11.92 ± 1.87	16.45 ± 1.99
		Post-intervention	18.19 ± 1.50	20.19 ± 1.46	17.75 ± 1.72	16.41 ± 1.67	23.08 ± 2.17
t value			6.283	7.014	5.096	3.051	3.785
p value			<0.001	<0.001	<0.001	0.003	<0.001

T A B L E 4. Satisfaction survey (n (%)).

Group	Case	Satisfaction	Basically satisfied	Dissatisfied	Satisfaction
Conventional care group	35	10 (28.57)	14 (40.00)	11 (31.43)	68.57%
Observation group	35	21 (60.00)	11 (31.43)	3 (8.57)	91.43%
χ^2 value					8.835
p value					0.012

T A B L E 5. Compliance survey (n (%)).

Group	Case	Full compliance	Partial compliance	Non-compliance	Overall compliance rate
Conventional care group	35	11 (31.43)	19 (54.29)	5 (14.29)	85.71%
Observation group	35	22 (62.86)	12 (34.29)	1 (2.86)	97.14%
χ^2 value					7.914
p value					0.019

comprehensive psychological support and improving overall nursing outcomes. The network-based continuous nursing model, utilizing widely adopted platforms such as WeChat, QQ (version 2019.0, Shenzhen Tencent computer system Co., Ltd., Shenzhen, Guangdong, China), is a prime example of such an approach. Previous studies have demonstrated the effectiveness of this model in various disease care, including cancer [26–28]. In this present study, we primarily focused on continuous nursing facilitated through the WeChat platform, which involved addressing patients' challenging questions with input from attending breast cancer physicians to design postoperative rehabilitation plans and provide ongoing supervision and psychological support from medical staff. Regular patient exchange meetings serve as a platform for patients to alleviate negative emotions, feel supported by society and build confidence in overcoming their illness.

This study compared network-based continuous nursing with conventional postoperative care for breast cancer patients. Our findings revealed a significant decrease in SAS and SDS scores six months after intervention in the observation group. These scores can be used as indicators for evaluating patient anxiety and depression. In our study, using these scores, we confirmed a significant improvement in these aspects among patients in the observation group, indicating the effectiveness of the network-based continuous nursing model in improving patients' mental well-being, which might be attributed to the model's integration of nursing intervention into patients' daily lives. Additionally, regular self-assessment surveys provide timely feedback on patients' mental status and allow for communication tailored to their psychological needs, thereby helping to alleviate adverse emotions and adjust mental states. Furthermore, the observed increase in quality of life scores among breast cancer patients in the observation group highlights the positive

impact of network-based continuous nursing on quality of life. This improvement is likely attributable to the supervision and guidance provided by medical staff. Furthermore, the questionnaire survey on nursing satisfaction and treatment compliance revealed significantly higher levels of satisfaction and compliance in the observation group compared to the conventional care group. This finding aligns with previous literature [29], further validating the effectiveness of network-based continuous nursing in enhancing nursing satisfaction and indicating greater patient acceptance of this approach. Lastly, the incidence of adverse reactions post-intervention was compared between the two groups. The total adverse reaction rate in the observation group was significantly lower than that in the conventional care group, suggesting that the network-based continuous nursing model is safer, evidenced by the effective reduction in the probability of adverse reactions, which may be attributed to the provision of scientific rehabilitation guidance.

4. Conclusions

The network-based continuous care model, incorporating the use of WeChat software and traditional continuous care, offers several advantages, such as enhancing patient follow-up, facilitating the collection and analysis of patient data regardless of geographical limitations imposed by epidemics, and improving nursing outcomes following breast cancer surgery. It also effectively enhances patients' psychological well-being and quality of life, increases nursing satisfaction and compliance, and reduces the incidence of postoperative adverse events. However, the network-based continuous nursing model may also have certain limitations. As the population ages, the demand for network-based nursing is expected to rise, necessitating a significant investment in nursing human resources, particularly experienced nurses. Additionally, the home-based nature of network nursing may impose limitations in managing adverse drug reactions and administering certain treatments, potentially leading to treatment delays. Furthermore, the lack of emergency equipment and immediate access to emergency medical services online poses risks to patient safety. Therefore, continuous improvement of the network-based continuous nursing model is essential, requiring collaboration among government agencies, hospitals, communities and internet platforms.

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

YHZ and YL—designed the study and carried them out; prepared the manuscript for publication and reviewed the draft of the manuscript. YHZ, YL and MP—supervised the data collection. YHZ, YL, MP, YLX, JW, YH and WL—analyzed the data, interpreted the data. All authors have read and approved the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

ACKNOWLEDGMENT

FUNDING

CONFLICT OF INTEREST

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