Effect of evidence-based nursing intervention on upper limb function in postoperative radiotherapy patients with breast cancer

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Abstract

To investigate the effect of evidence-based nursing (EBN) intervention on upper limb function in postoperative breast cancer patients undergoing radiotherapy.

A total of 126 breast cancer patients who had received postoperative radiotherapy in the Union Hospital affiliated with Tongji Medical College, Huazhong University of Science and Technology from September 2017 to September 2018 were randomly divided into 2 groups, namely, experimental and control groups, with 63 cases in each group. Both the control and experimental groups received routine postoperative radiotherapy followed by traditional and EBN interventions, respectively. All patients were followed up for 6 months and differences in the upper limb function after nursing intervention were compared between the 2 groups.

The scores of self-rating anxiety scale (SAS), self-rating depression scale (SDS), and short form-36 survey (SF-36) in the 2 groups had no statistical significance before intervention. After the EBN intervention, the SAS and self-rating depression scale scores of patients in the experimental group were lower than that of those in the control group. In the experimental group, 90.67% of the patients had an excellent score for the University of California, Los Angeles shoulder score, which was higher than that of the control group (73.92%). The Mayo Elbow Performance Score of the experimental group (95.01) was higher than that of the control group (91.33). The total length of the sum of arm circumference in the experimental group was (128.39 cm) lower than that of the control group (143.66 cm). The scores of SF-36 in the overall health, physical pain, mental health, and physiological functions of the patients in the experimental group were higher than those of the control group. All of these parameters' differences between the 2 groups were of statistical significance ($P < .05$).

EBN can positively influence the negative emotional state of breast cancer patients after radiotherapy. At the same time, it is helpful in reducing the degree of lymph node edema on the affected side of the upper limb, thereby improving the function of the shoulder joint, which has a positive effect on the upper limb function.

Abbreviations: EBN = evidence-based nursing, SAS = self-rating anxiety scale, SDS = self-rating depression scale, SOAC = sum of arm circumference, UCLA = University of California.

Keywords: breast cancer, evidence-based nursing, radiotherapy, upper limb function

1. Introduction

Invasive breast cancer is the most common malignancy in women, accounting for 23% of all cancers in women globally, and 27% in affluent countries.[1] At present, surgery is still the primary treatment for breast cancer, but it also has some unavoidable postoperative complications, 1 of which is the upper limb dysfunction of the affected side. In addition, postoperative radiotherapy can cause local tissue edema, muscle contracture, and scar formation, aggravating upper limb dysfunction. In recent years, despite the advancements in radiotherapy methods such as 3-dimensional conformal radiotherapy and intensity-modulated radiotherapy, there are still certain minor side effects. Hence, studies in the field of recovery of upper limb function in breast cancer patients after radiotherapy has important clinical significance. With the deepening of evidence-based nursing (EBN) research, a nursing practice based on real and reliable scientific evidence from patients, the traditional narrow empiricism model of nursing is transforming into a new concept of nursing.[2] The purpose of this study is to explore the effect of EBN on upper extremity function by coupling it with postoperative radiotherapy among breast cancer patients.

2. Materials and methods

2.1. General information

A total of 126 patients who had received postoperative radiotherapy for breast cancer from September 2017 to September 2018 in the Union Hospital affiliated with Tongji

Medical College, Huazhong University of Science and Technology were selected. The patients were all female, aged 39 to 75 years, with an average of 58.9 ± 11.4 years. Inclusion criteria:

(1) All patients diagnosed with breast cancer by comprehensive examination of imaging, pathology, and biology; and who underwent modified radical mastectomy for breast cancer;
(2) Female;
(3) Patients conforming to the standard of radiotherapy for breast cancer.

Exclusion criteria:

(1) Postoperative recurrence of breast cancer;
(2) Primary diseases of upper limbs or limb dysfunction;
(3) Unable to cooperate with workers due to mental health issues;
(4) Complicated with organ dysfunction.

The patients were divided into an experimental and a control group with 63 patients in each group according to the nursing mode they received. The experimental group patients received EBN intervention and were 46 to 72 years old, with an average age of 58.4 ± 12.0. The control group patients received traditional nursing intervention and were 44 to 69 years old, with an average age of 56.0 ± 11.3. The Ethics Society approved this study and the patients' informed consent was taken. There were no significant differences in the baseline clinical and demographic data between the 2 groups.

3. Method

Postoperative radiotherapy in both groups was performed by the same team with professional qualifications and extensive experience at the supraclavicular region, axillary fossa, and chest wall according to the 2017 National Comprehensive Cancer Network (NCCN) Breast Cancer Practice Guide.[3] Postoperative radiotherapy mainly includes 3-dimension x-ray beams (3-D XB) and 3-D XB with electron beams (EB). The radiotherapy dose of 3-D XB was 6 MV x-ray 50 Gy/25 times and the radiotherapy dose of 3-D XB with EB was 26 Gy/13 times and 244 y/12 times.

The control group received routine nursing intervention, including health education after admission, teaching, and training on the importance of upper limb functional exercise after operation and during radiotherapy, and basic exercises to help patients recover their upper limb function.

3.1. EBN

1. Questions: What are the relevant factors affecting the upper limb function of patients undergoing postoperative radiotherapy and the types of upper limb functional exercises available?

   Studies have shown that the incidence of upper limb lymphedema after radical mastectomy or modified radical mastectomy is 36% to 65%. The main manifestations are upper limb movement limitation and muscle weakness that seriously affects the quality of life of breast cancer patients after operation.[4] Since there is a self-aggravating vicious circle in the pathogenesis, the incidence increases gradually with the passage of time.[5] It has been reported that the incidence of mild upper limb lymphedema after breast cancer surgery is 41% and moderate to severe edema is about 15%, leading to upper limb dysfunction and mental depression.[6]

2. Evidence-based support: Apply evidence-based method to find out the cause of the problem.

   "Breast cancer", "modified radical surgery", "radiation therapy", and "upper limb function" were used as keywords to search the literature in PubMed, Web of Science, and Google Scholar, and high-quality literature was selected for intensive reading. The main reasons for the dysfunction are as follows:

   (1) Post operation: Excision of axillary lymph nodes leading to a blockage in the lymphatic reflux of the upper limbs after lymphatic vessel ligation; Venous obstruction, venous adhesions, and lymphadenitis caused by thrombophlebitis results in protein aggregation in tissues, which increases osmotic pressure and water absorption capacity, leading to lymphedema of the affected limbs; and the damage of blood vessels and nerves during operation will affect the sensory and motor functions of the affected upper limbs.
   (2) Postoperative radiotherapy: Radiotherapy causes venous occlusion and lymphatic vessel destruction in the radiation field. Radiotherapy can also lead to tissue edema, muscle contracture, and scar formation, which can aggravate upper limb dysfunction.

3. Formulating a nursing plan and intervention with the best evidence:

   (1) Pain relief: Roses et al reported that intractable pain and numbness in the axillary lymph node, chest wall, and upper arm of the affected side after breast cancer dissection were common phenomena. About 25% of patients suffered from persistent pain after operation.[7] Persistent pain not only affects normal activities, but also aggravates the patient's psychological burden, reduces compliance for functional exercise, and prolongs recovery. Therefore, relieving pain is an important measure for early functional exercise and long-term adherence to treatment.
   (2) Psychological intervention and health education: The key is to understand the patient's psychological state and communicate with a positive attitude to help alleviate their negative emotions. Regular health education was given to help them correct bad habits, to explain the importance of upper limb functional exercise, and to improve patients' treatment compliance.
   (3) Massage and traction of the affected limbs: Relaxing and massaging the shoulder muscles of the affected upper limbs; kneading of the trapezius muscle, the muscles around the rotator cuff, the supraspinatus muscle, and the infraspinatus muscle was carried out. At the same time, the nurse assisted the patient to perform passive back extension exercise of the shoulder joint. The strength of the traction was based on the degree of the patient's pain sensitivity, with an average of 3 times a day for 10 minutes each time.
   (4) Upper limb rehabilitation exercise: Timely and reasonable upper limb functional exercise can make the axillary lymph node heal flat and fully play the compensatory role. When performing radiotherapy, exercises to minimize the edema caused by radioactive muscle fibrosis cannot be relaxed. Finger exercises can be done on the same day after operation. The wrist and hand joints can be exercised 1 to 3 days after operation; elbow joints after 4 to 8 days to avoid abduction of upper arm; and shoulder joints on the 8th day. Exercises were performed 3 to 5 times a day, with

Table 1

Demographic characteristics of patients.

Characteristics	Bridge to surgery group (n=63) Number of patients%	Emergency operation group (n=63) Number of patients%	P
Age, yr	58.79±10.75	56.86±11.28	.326
Sex			.675
Male	35 (55.6)	40 (63.5)	
Femal	28 (44.4)	23 (36.5)	
BMI	22.53±3.09	22.41±2.73	.132
Pathological types			.914
Nvasive ductal carcinoma	34 (54.0)	38 (60.3)	
Medullary carcinoma	10 (15.9)	12 (19.1)	
Invasive special type of cancer	19 (30.1)	13 (20.6)	
TNM stage			.936
I	5 (7.9)	7 (11.1)	
II	25 (39.7)	20 (31.7)	
III	33 (52.4)	36 (57.1)	
Lymph node(number)	23.86±10.55	19.81±8.30	.349
Adjuvant radiotherapy			.773
3-D XB*	37 (58.7)	29 (46.0)	
3-D XB+EB*	26 (41.3)	34 (54.0)	

3-D XB* = 3-dimension x-ray beams, BMI = body mass index, EB* = electron beams.

the interval between 2 exercises being not less than 2 hours, and the time for each exercise being not less than 15 minutes.

3.2. Observation indicators and efficacy criteria

The self-rating depression scale (SDS) and self-rating anxiety scale (SAS) were used to identify the patient's emotional state and a lower score indicated a better mood.[8] Sum of arm circumference (SOAC) is the measurement of arm circumference at 20 cm, 15 cm, and 5 cm above and below the elbow joints, plus the total circumference of the wrist and metacarpophalangeal joints.[9] The Mayo Elbow Performance Score (MEPS), developed by Morrey in 1992, was used to evaluate the elbow joint function. The scale has a maximum score of 100 to 45 for pain, 20 for motor function, 10 for stability, and 25 for daily activities.[10] The shoulder scores of the patients were scored using the University of California, Los Angeles (UCLA) scoring system. In the 1981 edition of UCLA shoulder score, subjective evaluation of the patient was based on their pain; objective evaluation was based on the doctor's physical examination of functional activity, shoulder mobility, and muscle strength.[11] The total score was 35 points - a score less than 29 was rated as poor, 29 to 33 was rated as good, and 34 to 35 was rated as excellent.[12] Short form-36 survey (SF-36) was used to assess the quality of life of the patients, and those with high scores indicated a high quality of life.

3.3. Statistical analysis

All data were analyzed using the statistical package SPSS version 23.0. All measurement data were represented as ($\overline{x}\pm s$). The

paired t test was used in the group, and the analysis of variance was used in the group. The count data were expressed in percentage (%), and the data were processed by chi square test, and $P < .05$ was considered statistically significant.

4. Results

We compared the basic characteristics of the patients (age; sex; body mass index; type of breast cancer; tumor node metastasis stage; node dissection; and radiotherapy dosage), and the results showed that there was no statistical significance between the 2 groups ($P > .05$) before EBN intervention (Table 1). Similarly, there was no significant difference in the self-rating depression scale (SDS) and SAS scores between the 2 groups before EBN intervention. However, after the intervention, SAS and SDS scores of the patients in the experimental group were lower than those in the control group (Table 2). After EBN intervention, the UCLA shoulder score in the experimental group was higher than that in the control group (91.67% vs 72.92%). The MEPS of the experimental group patients was higher than that of the control group (94.11 vs 90.23). The total length of SOAC in the experimental group was lower than that of the control group (126.39 cm vs 145.26 cm) (Table 3). The overall health, social function, physiological function, mental health, physical pain, physical limitations, vitality, and emotional functions of the patients in the experimental group were higher than those of the control group (Table 4). The differences between the groups, of all the above parameters, was statistically significant ($P < .05$).

Table 2

Comparison of SDS and SAS scores between the 2 groups ($\overline{x}\pm s$).

Group	Time	SAS	SDS
Control group (n=63)	Before intervention	61.20±5.39	65.71±6.52
	After intervention	44.10±2.53	41.19±3.37
Experimental group (n=63)	Before intervention	62.27±5.13	64.29±6.67
	After intervention	31.21±0.54	27.95±2.69

SAS = self-rating anxiety scale, SDS = self-rating depression scale.

Table 3

Upper limb function before and after intervention in 2 groups ($\overline{x} \pm s$).

Group	UCLA	Mayo	SOAC
Experimental group (n=63)	33.26±0.75	94.11±2.40	126.39±5.72
Control group (n=63)	27.53±0.49	90.23±2.18	145.26±5.30
t	44.296	41.612	52.825
P	<.05	<.05	<.05

SOAC = sum of arm circumference, UCLA = University of California.

5. Discussion

The evidence-based approach stems from a new paradigm of medicine, evidence-based medicine, developed as a learning method by epidemiologists at the McMaster University, Canada,[13] It is a new nursing model based on the analysis and processing of "big data" by setting up the problems to be solved, summarizing the literature with reference values, and summarizing the reports from various forms of scientific research results. In the actual application process, the scientific research basis, the nurse's skills, and the individualized needs of patients are combined to formulate scientific and comprehensive nursing measures.[14] It is considered to be one of the most important factors to improve the quality of health care and patient health outcomes.[15–18] It not only proves the value of nurses and makes nursing activities more scientific and professional, but it also provides opportunities for improving the authority, promoting the development, and independence of nursing disciplines.[13] Our Department has established a professional EBN team, which encourages the members to focus on discussing patients' condition. By combining available professional literature and patients' actual condition, we can formulate appropriate EBN plans and administer systematic nursing for patients. This evidence-based care team, a responsible group, is conducive to the development and implementation of individualized care measures. This approach is more effective as the problems and nursing measures are more closely linked and hence, the care received by the patients is more refined with a stronger purpose.

Upper limb dysfunction is common in breast cancer patients after radiotherapy. Bosompra et al found that 63% of the patients after surgery had upper body numbness, 35% had significant swelling, 13% to 15% had different degrees of pain, and 1% to 4% had shoulder joint abduction limitation and muscle weakening.[19] This may be related to various factors such as surgical trauma, postoperative muscle contracture, and radiotherapy damage, which not only affects the quality of life of the patients, but also has a negative impact on their psychology.

Table 4

Comparison of SF-36 indices between 2 groups ($\overline{x} \pm s$).

	Experimental group (n=63)	Control group (n=63)	T	P
Overall health	86.52±3.45	64.31±2.32	47.163	.036
Social function	85.69±3.24	64.32±2.05	41.091	.006
Physiological function	84.23±3.21	60.14±2.43	44.637	.003
Mental health	87.68±5.15	65.96±3.35	28.265	.000
Physical pain	90.14±3.22	71.06±2.41	32.753	.002
Physical limitations	85.68±3.15	61.14±2.34	43.543	.015
Vitality	91.37±2.54	68.21±3.16	34.058	.005
Emotional functions	82.52±3.68	58.31±2.62	42.139	.024

Therefore, the nurse should communicate with the patient and his family to find out the psychological state of the patient and give corresponding psychological care. At the same time, when instructing patients to exercise their limbs, they should be nursed strictly, according to the actual condition of the patients, evidence-based skills, and clinical experience, and gradually carry out functional exercises to help them recover their normal limb function.

The recovery of upper limb function occurs due to a significant reduction in the degree of edema in the affected limb that consequently improves the function of the shoulder joint. There are also some limitations to our study. First, as a retrospective study, patient inclusion biases may have occurred. Second, The sample size is not large, and the reliability of the results needs to be further verified. In conclusion, our study shows that EBN intervention in breast cancer patients undergoing postoperative radiotherapy can significantly improve the quality of life of the patients by enhancing their upper limb function and thereby their mental health.

Author contributions

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