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Original Article

Comparative study of the application of high-quality nursing care and routine nursing care in postoperative rehabilitation of breast cancer patients

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Abstract: Objective: The aim of this study was to investigate the impact of high-quality nursing care (HQNC) on postoperative recovery following breast cancer surgery. Methods: A total of 240 consecutive breast cancer patients, admitted from January 2015 to June 2017, were included and randomly assigned to the experimental group or control group, each group containing 120 patients. The experimental group received postoperative HQNC, while the control group received routine postoperative care. Assessments were made at 10 days, 1 month, and 3 months following breast cancer surgery, based on range of motion (ROM) of ipsilateral shoulder joints, visual analogue scale (VAS) scores of neck and shoulder pain, immune function (T-cell subset (CD3+, CD4+, CD8) counts and CD4/CD8 ratio), serum levels of interleukins (IL-1β, IL-2, IL-6), and Quality of Life Scale (QoLS) scores. Results: There were no significant differences in ROM or VAS scores between two groups before surgery or at 10 days after surgery (all $P>0.05$). However, the experimental group reported better shoulder mobility and improved VAS scores than controls at 1 month and 3 months postoperatively (all $P<0.05$). No significant differences were observed, prior to surgery, regarding immune function or QoLS scores (both $P>0.05$). However, after surgery, at 10 days, 1 month, and 3 months, the experimental group showed greater values of T-cell subset counts, interleukins levels, and QoLS scores than the control group (all $P<0.05$). Conclusion: HQNC contributes to postoperative recovery of shoulder function and immune function, thereby improving the quality of life in breast cancer patients.

Keywords: High quality nursing care, breast cancer, immune function, recovery

Introduction

Breast cancer is one of the most common malignant tumors in women worldwide, with high incidence and mortality comprising a major threat to women's physical and mental well-being [1, 2]. Each year, there are 1.2 million new cases of breast cancer, worldwide. Approximately 15% will die. China has reported that 269,000 people have been diagnosed with breast cancer annually, with the number of breast cancer deaths reaching 70,000 each year [3]. Although various types of treatment strategies, including surgery, chemotherapy, radiotherapy, and targeted therapy, have markedly increased patient survival rates in recent years, the disfiguring nature of the surgery, along with therapy-related pain and impaired immune function, have drastically jeopardized the health of breast cancer patients, both physically and emotionally [4, 5].

High Quality Nursing Care (HQNC) is a recent innovation in the nursing field. It integrates solitary therapeutic intervention with patient-centered nursing care, creating a comprehensive combination of nursing practice focused on treatment effectiveness, patient safety, and patient experience. Compared with routine nursing care alone, HQNC has shown notably improved cure rates in multiple clinical departments [6, 7]. Since 2008, HQNC has been predominantly used in chronic diseases, such as hypertension, diabetes, cancer, and COPD, contributing to disease remission and remarkable improvements in quality of life [8, 9]. Since very few studies have focused on the effects of HQNC on postoperative recovery in breast can-

cer patients, the current study was carried out to determine whether HQNC may have a positive impact on recovery of shoulder joint function and immune function, as well as on quality of life, after breast cancer surgery.

Materials and methods

Patients

A total of 240 consecutive female breast cancer patients, admitted to Affiliated Nanhua Hospital, University of South China, from January 2015 through June 2017, were recruited and randomly allocated to either the experimental group or control group, with each group containing 120 patients. During the study, all patients underwent breast cancer surgery for the first time. They were treated with chemotherapy and radiotherapy before surgery. There were 32 diabetic patients in the experimental group and 38 in the control group. The protocol of this study was approved by the Ethics Committee of Affiliated Nanhua Hospital, University of South China.

Inclusion criteria: Subjects underwent their first modified radical mastectomy and diagnosis was confirmed with pathology; Subjects had no impaired limb movement before surgery; Subjects agreed to be enrolled in this study and provided written informed consent.

Exclusion criteria: Subjects had critical organ dysfunction; Subjects were not cooperative with rehabilitation training; Subjects had cancer metastases to other organs; Subjects refused to be enrolled in the study.

Methods

Grouping and interventions: All patients were informed of the indications, risks, and benefits of the surgery and provided written informed consent. The consent process complied with the code of ethics. Patients agreed to be followed-up via phone calls and hospital visits.

The control group received routine nursing care and preoperative education. Patients were closely monitored and took medicine according to doctor's instructions.

The experimental group was given HQNC. In establishing a positive and trust-worthy nurse-patient relationship, all patients were given psychological assessments before surgery. Individualized nursing care regimens were devised based on each patient's mental status. Patients were provided with psychological treatment and interpatient communication to gain a better understanding of the surgery, relieving anxiety. Immediately after surgery, vital signs were closely monitored. Patients were educated about caring for the incision and drainage tube. Wound pain was graded and treated with patient-controlled analgesia pumps or oral analgesics. These were stopped 48 hours after surgery. Step-wise exercises were introduced to maintain upper limb function. Before they could eat by mouth, patient mouths were moisturized with water-soaked cotton swabs. Patients were given a full liquid diet 6 hours after surgery, gradually transitioning to a semi-liquid diet and a regular diet.

Range of motion (ROM) of ipsilateral shoulder joints: Reference values for normal shoulder ROM: flexion: 180°; extension: 60°; abduction: 180°; adduction: 75°; internal rotation: 90°; external rotation: 70° [10].

Visual analogue scale (VAS) scores of ipsilateral arm pain: Patients were asked to report pain intensity using a 0-10 scale: 0 represents no pain; 1-3: mild pain and bearable; 4-6: moderate pain that affects sleep; 7-10: severe and unbearable pain [11].

T-cell subset (CD3+, CD4+, CD8) counts and CD4/CD8 ratios: Briefly, 5 mL of whole blood was drawn from each patient into tubes. Fluorescently labeled CD4 and CD8 monoclonal antibodies (Cell signaling, U.S.A., diluted to 0.5% in 1× BSA in PBS) were added to each tube based on target T-cell subsets. The tubes were mixed gently and incubated in the dark at room temperature for 15 minutes. Next, 1 mL RBC lysis buffer was added and allowed to sit in the dark for 10 minutes. The tubes were centrifuged, then the supernatant was discarded. Samples were washed 3 times with PBS, then mixed with 1 mL PBS before analysis by flow cytometry. T-cell subset (CD3+, CD4+, CD8) counts and CD4/CD8 ratios were obtained using kit software.

Serum levels of interleukins: Fasting peripheral blood was drawn into tubes. Samples sat for 2 hours before being high-speed centrifuged at a low temperature. Supernatant serum was col-

Table 1. Comparison of general conditions (mean ± sd)

Groups	Experimental group (n=120)	Control group (n=120)	t/χ^2	P
Age (year)	42.7±13.5	44.7±12.3	1.200	0.232
Clinical stage			0.168	0.919
Stage I	33	34		
Stage II	63	60		
Stage III	24	26		
Surgery types			0.711	0.871
Breast-conserving	32	35		
Modified radical mastectomy	60	58		
Radical mastectomy	23	20		
Others	5	7		
Comorbidities			1.779	0.411
Hypertension	58	60		
Diabetes	32	38		
Others	30	22		

lected. Interleukin ELISA kits (IL-1β: MAB602, R&D, U.S.A.; IL-2: MAB206, R&D, U.S.A.; IL-6: AF-210-NA, R&D, U.S.A.) were used to measure OD values of IL-1, IL-2, and IL-6. Concentrations of each interleukin were determined based on the standard curve.

Cancer patients Quality of Life Scale (QoLS) scores: This scale is based on draft questionnaires of the cancer patient Quality of Life Scale, developed in 1990. Total scores range from 0-60 by adding up the scores of 12 different items, including appetite, activity, sleep, fatigue, pain, family understanding and cooperation, colleague understanding and cooperation, understanding of cancer, attitudes towards treatment, impact on daily life, therapeutic side effects, and facial expressions.

Scores are grouped into 5 categories: 51-60: excellent; 41-50: very good; 31-40: good; 21-30: fair; less than 20: poor [12].

Statistical analysis

All data were analyzed with SPSS 13.0 statistical package. Quantitative values are expressed as mean ± sd and differences between groups were evaluated using independent t-test. Enumeration data are expressed as number/percentages (n/%) and differences between groups were compared using χ^2 test. *P*-values less than 0.05 indicate statistical significance.

Results

General conditions

There were no significant differences in age, breast cancer staging, surgery types, or comorbidities between the two groups (all P<0.05). See **Table 1**.

ROM of ipsilateral shoulder joints

No significant differences were detected in ROM of ipsilateral shoulder joints between the two groups at 10 days after surgery (P> 0.05). However, at 1 month and 3 months, the experimental group showed better ROM than controls (both P<0.001). See **Table 2** and **Figure 1**.

VAS scores of ipsilateral upper limbs

Both groups had similar VAS scores of ipsilateral arm pain at 10 days after surgery (P>0.05). At 1 month and 3 months, the experimental group had significantly lower scores than the control group (both P<0.05). See **Table 3** and **Figure 2**.

Immune function

Before surgery, there were no differences between the two groups regarding T-cell subset (CD3+, CD4+, CD8) counts and CD4/CD8 ratios or serum levels of interleukins (IL-1β, IL-2, IL-6) (P>0.05). At 10 days, 1 month, and 3 months after surgery, the experimental group had significantly higher levels than controls (all P< 0.05). See **Tables 4**, **5** and **Figures 3**, **4**.

QoLS scores

The experimental group had better QoLS scores than controls at 10 days, 1 month, and 3 months after surgery (all P<0.001). There were no differences between the two groups before surgery (P>0.05). See **Table 6** and **Figure 5**.

Discussion

In 2013, the International Agency for Research on Cancer reported that breast cancer had

Table 2. Comparison of ROM of ipsilateral shoulder joints (mean ± sd)

ROM	Baseline	At 10 days	At 1 month	At 3 months
Experimental group				
Flexion	172.34±1.45	112.45±10.31	145.49±9.34***	170.48±14.56***
Extension	49.28±3.49	31.28±7.28	40.37±7.27***	48.29±8.19***
Adduction	51.38±5.65	38.34±4.65	41.56±4.67***	48.28±4.67***
Abduction	173.38±5.29	111.29±12.47	139.39±12.38***	167.29±12.49***
Internal rotation	68.32±6.28	38.38±10.34	57.39±2.38***	66.39±5.56***
External rotation	74.49±8.28	48.29±12.48	62.38±11.23***	72.39±6.59***
Control group	170.13±1.57	113.04±11.14	105.33±8.45	160.33±12.35
Flexion	48.52±3.63	31.82±6.88	40.44±8.39	46.36±7.22
Extension	48.68±5.68	30.11±8.78	35.45±8.34.	40.28±8.42
Adduction	172.38±1.43	108.32±11.45	114.65±11.67	152.56±11.52
Abduction	65.43±5.34	39.69±4.58	46.45±3.87	49.58±4.69
Internal rotation	72.28±9.68	46.43±11.23	52.41±11.47	62.29±5.51
External rotation	172.34±1.45	112.45±10.31	145.49±9.34***	170.48±14.56***

Note: Compared with the control group at the same time, ***P<0.001. ROM, range of motion.

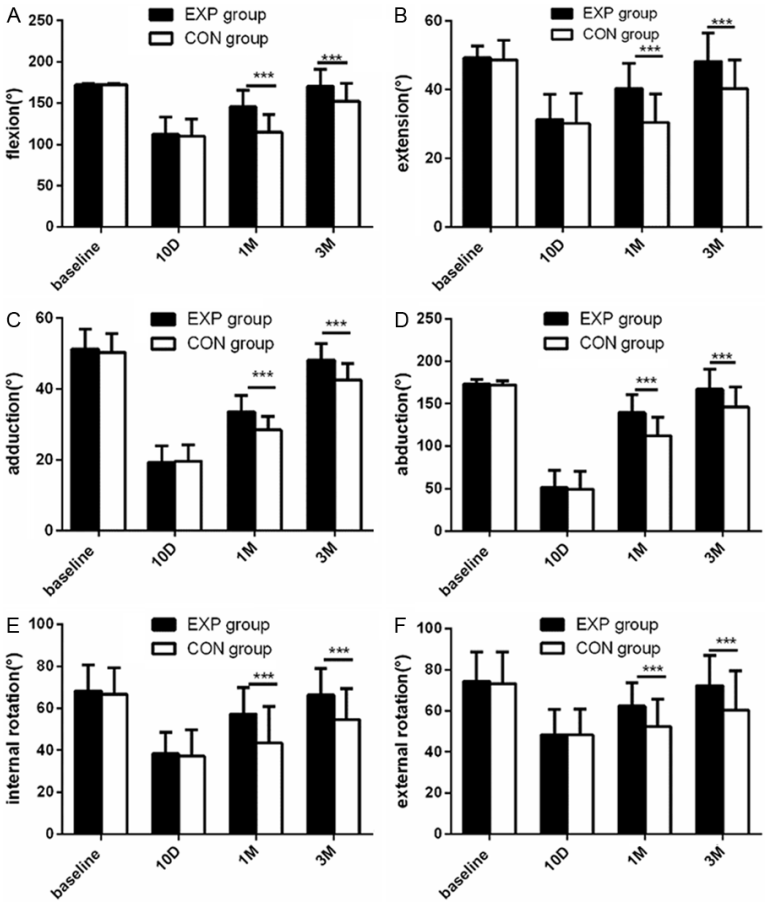

Figure 1. Comparison of ROM of ipsilateral shoulder joints. A-F: Represents shoulder; flexion, extension, adduction, abduction, internal rotation, and external rotation, respectively; EXP group: experimental group; CON group: control group; baseline: contralateral shoulder joints; 10D: at 10 days after surgery; 1M: at 1 month after surgery; 3M: at 3 months after surgery; ***P<0.001. ROM, range of motion.

become a major factor posing a great threat to the well-being of women. Death caused by breast cancer accounts for 1/4 of cancer-related mortality [13]. Surgery is the dominant therapeutic intervention, currently. Surgery types include breast-conserving surgery, modified radical mastectomy, and radical mastectomy [14]. Many patients are also treated with adjuvant chemotherapy, radiotherapy, and targeted therapy. Since metastases to armpit lymph nodes is frequently found in breast cancer, axillary lymph node dissection (ALND) is often performed during surgery. ALND involves removing all "cushion" soft tissues in the armpit and chest wall. As a result, skin flaps directly adhere to axillary vessels, causing multiple postoperative complications. One complication is arm swelling and pain. If not treated with long-term appropriate functional training exercises, the mobility of ipsilateral shoulder joints could be compromised, resulting in adherence in the shoulder girdle. This, in turn, aggravates the arm pain [15].

Table 3. Comparison of VAS scores of neck and shoulder pain (mean ± sd)

Time	Experimental group (n=120)	Control group (n=120)	t/χ^2	P
Baseline	8.32±1.25	7.89±2.13	1.907	0.058
At 10 days	7.58±1.39	7.22±1.57	1.881	0.061
At 1 month	4.28±0.32	6.29±0.58	33.239	<0.001
At 3 months	2.37±0.29	4.36±0.63	31.432	<0.001

Note: VAS, visual analogue scale.

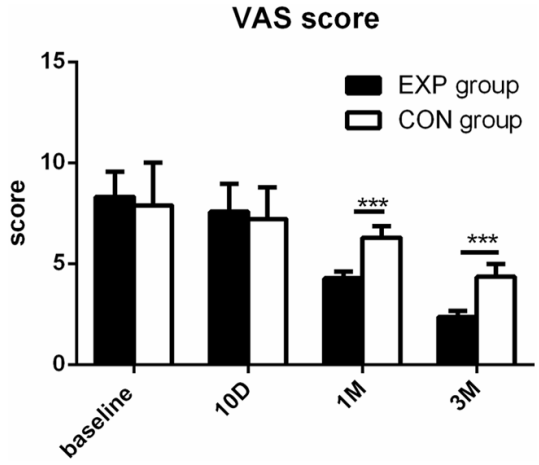

Figure 2. Comparison of VAS scores of ipsilateral limb pain. EXP group: experimental group; CON group: control group; 10D: at 10 days after surgery; 1M: at 1 month after surgery; 3M: at 3 months after surgery; ***P<0.001. VAS, visual analogue scale.

HQNC provides patients with directions to achieve appropriate and regular rehabilitation exercises. Therefore, HQNC is likely to promote local blood circulation and lymphatic drainage, attenuating exudation and further alleviating arm swelling and arm pain [16]. The Roberts study demonstrated that 60% of breast cancer patients would experience decreased ROM in ipsilateral shoulder joints after mastectomies with ALND [17]. HQNC may help with arm function recovery.

Brookham also reported that patients receiving HQNC had lower movement impairment rates because they were encouraged to do functional exercises in the early stages after surgery [18]. The current study showed that, through HQNC, shoulder kinematics improved significantly at 1 month and 3 months after surgery, but not at 10 days. This may be explained by the fact that patients were barely able to perform appropriate training exercises early after surgery due to wound pain.

A previous study demonstrated that, after surgery, 62% of breast cancer patients will develop neck and shoulder pain during a 6-year follow-up [19]. Castro-Martin also reported that the incidence rate of neck and shoulder pain in postoperative breast cancer patients was 9-68%. One possible reason would be that surgery affected neck and shoulder mobility, consequently causing arm pain [20]. Moderate pain could be relieved by rest, while severe pain would inevitably impair arm mobility, leading to decreased quality of life [21]. HQNC offers patients a tailored and reasonable training program which promotes wound healing and arm function recovery by improving blood circulation and exudation absorption. In the current study, VAS scores of neck and shoulder pain in the experimental group significantly decreased at 1 month and 3 months after surgery. Unfortunately, no differences were observed at 10 days. Results suggest that too much exercise at an early stage may aggravate wound oozing, likely causing bad sequelae, such as subcutaneous seroma, skin flap necrosis, and delayed wound healing.

In other studies, researchers revealed compromised tumor defense in breast cancer patients. Immune surveillance and immune defense were impaired to varying extents [22]. Cellular immunity, a specific immune response mediated by T-cells, plays a critical role in antitumor immunology. T-cells (CD4+ and CD8+) are the main regulatory factor during this antitumor process. CD4+ T-cell exerts its function by recognizing the MHC complex, while CD8+ cells function by direct killing [23]. Li reported that the immune system was boosted in gastric cancer patients after surgery through appropriate and regular functional exercises. However, underlying mechanisms were not studied [24]. Consistently, present data shows that HQNC contributed to increased T-cell subset (CD3+, CD4+, CD8) counts and CD4/CD8 ratios at 10 days, 1 month, and 3 months after surgery. Therefore, patients should expect a faster recovery of immune function.

IL-1β is a key member in the IL-1 family. It is the central mediator that regulates immune and inflammatory response. IL-2 also modulates immune response. One study suggested that breast cancer patients had reduced IL-2 secretion with decreased IL-2 function [25]. Jiang

Table 4. Comparison of serum levels of interleukins (mean ± sd)

Interleukins levels	Before surgery	At 10 days	At 1 month	At 3 months
Experimental group (n=120)				
IL-1β	3.44±0.19	2.67±0.23*	1.03±0.35*	0.23±0.37*
IL-2	4.92±0.51	2.27±0.52***	1.39±0.45***	0.65±0.44***
IL-6	2.59±0.56	1.36±0.12***	1.04±0.43***	0.43±0.22***
Control group (n=120)				
IL-1β	3.45±0.21	2.96±0.25	2.38±0.25	0.97±0.33
IL-2	4.94±0.55	3.38±0.44	2.87±0.28	1.39±0.23
IL-6	2.60±0.58	1.76±0.18	1.55±0.26	0.82±0.19

Note: Compared with the control group, *P<0.05; ***P<0.001.

Table 5. Comparison of T-cell subset (CD3+, CD4+, CD8) counts and CD4/CD8 ratios (mean ± sd)

T cells counts	Before surgery	At 10 days	At 1 month	At 3 months
Experimental group (n=120)				
CD3+	57.92±2.06	62.24±2.13***	68.72±2.48***	71.32±3.45***
CD4+	27.74±3.24	30.48±2.74***	32.38±2.38***	35.65±3.49***
CD8+	28.37±1.63	30.38±1.48***	34.55±1.49***	35.12±2.39**
CD4+/CD8+	0.98±0.05	1.04±0.03***	0.96±0.14***	1.04±0.19***
Control group (n=120)				
CD3+	58.39±2.38	60.48±1.21	65.28±2.31	68.37±3.27
CD4+	27.37±2.47	27.98±1.46	30.33±3.27	33.62±2.74
CD8+	28.48±1.58	28.38±1.41	32.14±4.20	34.28±2.87
CD4+/CD8+	0.99±0.09	0.95±0.06	0.88±0.18	0.90±0.21

Note: Compared with the control group, **P<0.01; ***P<0.001.

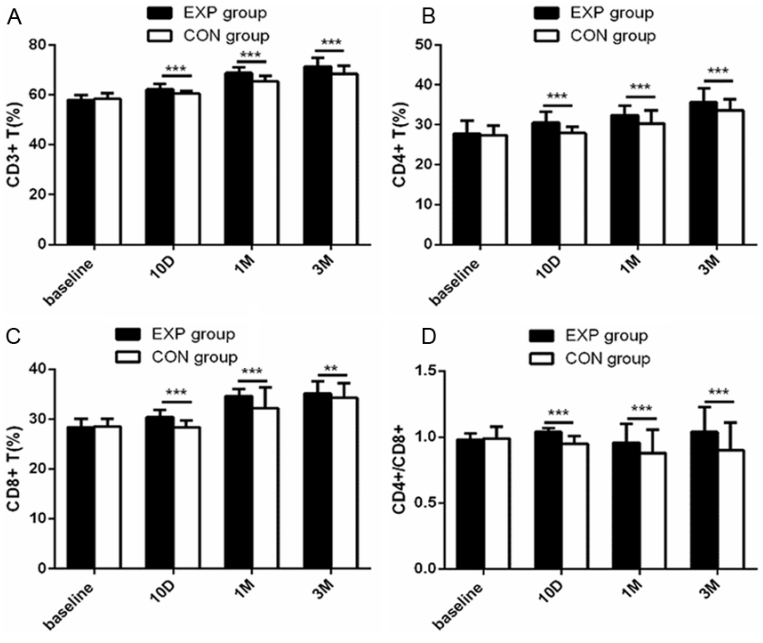

Figure 3. Comparison of T-cell subset (CD3+, CD4+, CD8) counts and CD4/CD8 ratios. A-D: Represents CD3+, CD4+, CD8, CD4/CD8 values, respectively; EXP group: experimental group; CON group: control group; baseline: before surgery; 10D: at 10 days after surgery; 1M: at 1 month after surgery; 3M: at 3 months after surgery; ***P<0.001; **P<0.01.

examined untreated cancer patients to find lower than normal IL-2 levels, which was negatively correlated with tumor metastases [26]. Hu found that, if treated with high concentrations of IL-2, metastatic lung cancer in mice would gradually disappear [27]. A core member of interleukins, IL-6 evidently suppresses tumor proliferation. Wolfe demonstrated that peripheral IL-6 levels were significantly elevated in breast cancer patients. Higher staging indicated higher IL-6 levels [28]. The current study confirms that, through HQNC, breast cancer patients will see significantly decreased IL-1β, IL-2, and IL-6, back to normal levels. This is indicative of reduced inflammatory response and improved immune function.

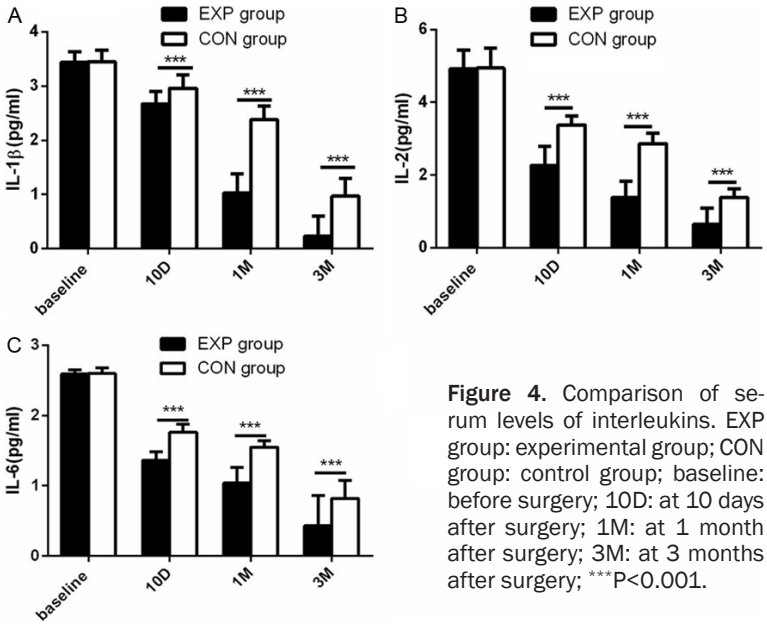

Figure 4. Comparison of serum levels of interleukins. EXP group: experimental group; CON group: control group; baseline: before surgery; 10D: at 10 days after surgery; 1M: at 1 month after surgery; 3M: at 3 months after surgery; ***P<0.001.

Table 6. Comparison of QoLS scores (mean ± sd)

Time	Experimental group (n=120)	Control group (n=120)	t/χ^2	P
Before surgery	32.45±2.47	32.58±2.59	0.398	0.691
At 10 days	45.39±2.41	40.43±2.48	15.712	<0.001
At 1 month	48.37±3.02	45.67±2.84	7.135	<0.001
At 3 months	51.39±3.45	48.32±2.55	7.839	<0.001

Note: QoLS, Quality of Life Scale.

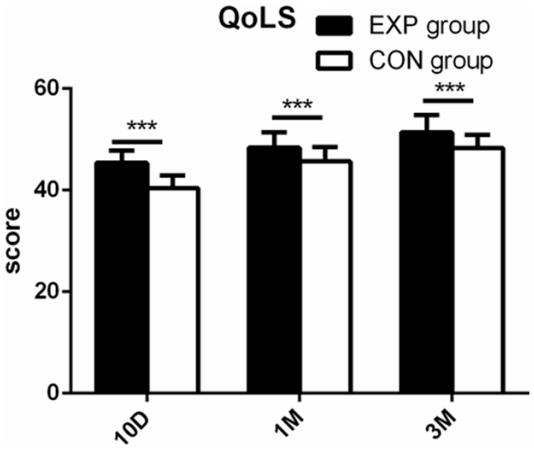

Figure 5. Comparison of QoLS scores. EXP group: experimental group; CON group: control group; 10D: at 10 days after surgery; 1M: at 1 month after surgery; 3M: at 3 months after surgery; ***P<0.001. QoLS, Quality of Life Scale.

Quality of Life (QOL) is an integrated index that incorporates physical, psychological, and social factors. Life threatening cancer diagnosis and the disfiguring nature of the surgery will consequently cause physical and emotional disturbances in patients. Treatment strategies should include regimens to correct negative mood and provide reassurance to relieve mental stress. In this study, patients in the experimental group achieved better QoLS scores at 10 days, 1 month, and 3 months after surgery. This provides further support that HQNC improves patient QOL and prolongs survival times.

The present study evaluated the effects of HQNC on shoulder mobility, immune function, and QOL in breast cancer patients. Similar studies are scarce in the literature. However, a limitation of the current study is the relatively small number of subjects. This may have impeded in-depth statistical analyses of outcomes. Further research is necessary to investigate the underlying mechanisms, examining whether HQNC improves prognosis by regulating cellular immunology in breast cancer patients.

In conclusion, HQNC is conducive to the recovery of shoulder mobility and immune function. It also relieves neck and shoulder pain after breast cancer surgery, further improving quality of life. HQNC can be effectively applied in clinical practice to improve the efficiency and quality of patient care.

Disclosure of conflict of interest

None.

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