The Effect of Self-administered Exercise on Breast Cancer Patients' Quality of Life

(Effect of Exercise on Breast Cancer Patient)

Makiko Kamio\textsuperscript{1}, Ken Uchida\textsuperscript{1}, Rei Mimoto\textsuperscript{1}, Yoshimi Imawari\textsuperscript{1}, Kumiko Kato\textsuperscript{1}, Hiroko Nogi\textsuperscript{1}, Kazumi Kawase\textsuperscript{1}, Yasuo Toriumi\textsuperscript{1}, Yumiko Onodera\textsuperscript{2}, Tsutomu Kuchiki\textsuperscript{2}, Hiroshi Takeyama\textsuperscript{1}

\textsuperscript{1}Jikei University School of Medicine, Department of Surgery

3-25-8, Nishi-shinbashi, Minato-ku, Tokyo, Japan

TEL: +81334331111 FAX: +81354724140

e-mail
Makiko Kamio: mkamio0811@gmail.com

Ken Uchida: kenucd@jikei.ac.jp

Rei Mimoto: reisan42@gmail.com

Yoshimi Imawari: yoshimi-i@jikei.ac.jp

Kumiko Kato: kukato@jikei.ac.jp

Hiroko Nogi: nogi_h@jikei.ac.jp

Kazumi Kawase: kawasekazumi@hotmail.com

Yasuo Toriumi: toris@jikei.ac.jp

Hiroshi Takeyama: takeyama@jikei.ac.jp

2 Meiji Yasuda Wellness Development Office,

Meiji Yasuda Life Foundation of Health and Welfare
神尾麻紀子 1）、三本麗 1）、井廻良美 1）、加藤久美子 1）、野木裕子 1）、川瀬和美 1）、鳥
海弥寿雄 1）、内田賢 1）、小野寺由美子 2）、朽木勤 2）、武山浩 1）

1）東京慈恵会医科大学 外科学講座

2）公益財団法人 明治安田厚生事業団 ウェルネス開発室
Abstract

Incidence of psychological symptoms and mood change in cancer patients is common. In this study we introduced the walking as mild aerobic exercise and observed prospectively mental status and quality of life (QOL) of Japanese breast cancer patients. 28 early breast cancer patients were recruited. Depressed mental status and QOL were assessed by Center for Epidemiologic Studies Depression Scale (CES-D) and Medical Outcomes Study 36-item Short Form Health Survey (SF-36). We instructed to perform walking program at one month post-surgery. Scores of CES-D and SF-36, and physical activity data were measured again at three months post-surgery. In the pre-surgery evaluation, eight patients (29%) were classified as depressed mental status, and depressed patients decreased to four at the three months post-surgery measurement. Six subscales of SF-36
significantly improved at three months post-surgery. Physical activity after intervention was correlated with the scores of CES-D and seven subscales of SF-36. This is the first prospective study demonstrating that exercise improved mental status and QOL of Japanese breast cancer patients. It is necessary to pay adequate attention to breast cancer patients’ mental health, regardless of whether they have a mental illness.
key words

breast cancer, exercise, quality of life, mental health, depression.
Introduction

It is widely known that cancer patients experience psychological symptoms and mood changes, and about 20% of cancer patients in the treatable stage experience depression\(^1\). Breast cancer is associated with a high rate of psychological symptoms: within one year of being diagnosed, close to half (48%) of breast cancer patients will experience depression or anxiety, or both \(^2\). The presence of psychological symptoms greatly affects the execution of treatment, with the concern that an interruption of treatment may result in the risk of a decreased cure rate. Additionally, treatment itself is related to decreased quality of life (QOL), fatigue, and influences psychological symptoms \(^3\). In terms of the relationship between psychological stress and cancer patient survival rate, previous reports have indicated that psychological factors and survival rates are
related each other in breast cancer patients\textsuperscript{4,5}.

Numerous studies have shown that exercise therapy is effective for psychological symptoms and decreased QOL in breast cancer patients\textsuperscript{6,7,8,9}. This study investigated whether self-administered walking program can improve depressive mental state and QOL in Japanese breast cancer patients.

Materials and Methods

Subjects

From April 2013 to August 2014, twenty eight patients were recruited from patients with primary breast cancer (clinical stages 0–III) at the age of 20 or more who considered having surgery at the Jikei University School of Medicine Hospital, Tokyo; we explained the study to the subjects and they gave written
consent. We excluded patients with a history of mental illness and those currently being treated for mental illness; patients who engaged in limited exercise due to a history of, or combination of, heart disease, respiratory disease, or musculoskeletal disease; and patients for whom the introduction of exercise was not possible. This study was performed with the approval of the Jikei University School of Medicine Ethics Committee (Approval no.: 24-337).

Study Protocols

We requested study participation from the patients who decided to have surgery and received participation consent. Walking program was introduced at an outpatient clinic one-month post-surgery. Before surgery, one-month post-surgery, and three-months post-surgery, we collected psychological
questionnaire responses and data on the amount of physical activity.

Evaluation Items

I. Mental State and QOL Evaluation

We evaluated depressed mental states and QOL using a self-response questionnaire. We used the following evaluation scales:

a) The Depression Self-response Evaluation Scale (Center for Epidemiologic Studies Depression Scale; CES-D). The National Institute of Mental Health (NIMH) developed this 20-item self-response depression evaluation scale in 1977. Each item is scored on a scale of 0–3, and a total score of 16 or higher is considered to indicate depression.

b) The SF-36® Japanese version. It measures health-related QOL. It is configured
to measure eight general health subscales. Each subscale is scored on a 0–100 scale, with high scores indicating greater health.\footnote{10}

II. Amount of Physical Activity Evaluation

Physical activity monitors (Lifecorder PLUS, Suzuken Co., Ltd., Nagoya, Japan, hereafter referred to as Lifecorder) were loaned to the subjects from the time of their post-surgery hospital discharge, with instructions to wear the Lifecorder at the waist all day. Recorded internal data of the amount of physical activity and exercise intensity were collected and entered during outpatient visits (one-month, and three-months post-surgery). Interviews were conducted to record activities and duration of exercise that could not be measured by the Lifecorder, such as swimming. The amount of physical activity was then calculated and entered.
a) Baseline amount of activity

The amount of physical activity was monitored until one month post-surgery. A baseline of physical activity was established from the average amount of physical activity during this period.

b) Introduction of exercise

Subjects were instructed to begin walking program after the baseline amount of physical activity was measured. The physical activity goals for individual subjects were to increase the amount of physical activity exceeding moderate intensity (corresponding to over 3 METs: on the Lifecorder, display of 4–9 intensity) from moderate intensity of the each baseline physical activity everyday. Subjects confirmed their amount of physical activity each day before bedtime, and record whether they met their goals on a recording sheet. If the average amount of
physical activity after intervention exceeded the baseline, we defined as the goal was achieved.

Control Group

As a previous research, from January 2009 to December 2010, we selected the patients by the eligibility criteria same as this study, and psychological questionnaires were collected. We recorded the post-surgery (at discharge) and three-month post-surgery CES-D scores of 39 breast cancer patients who did not engage in exercise, and used these as a control group to conduct a comparison with the subjects of this study. We were unable to conduct a comparison of SF-36 scores because of the difference in measurement intervals between the previous study and this study.
Statistical Analysis

Subject characteristics, the amount of physical activity, and the results of each evaluation scale were shown by the mean values ± standard deviation. We compared CES-D depression scores from each measurement period with a chi-squared test. CES-D and SF-36 scores were analyzed using single factor analysis of variance, and a multiple comparison test was performed. The amount of physical activity and the control group’s CES-D scores were analyzed using t-tests. We performed correlation analysis on the relationship between CES-D and SF-36 scores three months post-surgery and the amount of physical activity from one month post-surgery to three months post-surgery.
III. Endpoints

The primary end point is the evaluation data of depression and QOL at three months post-surgery (two months after intervention). The secondary endpoint is the correlation between the amount of physical activity and each evaluation item.

Results

I. Patient characteristics

The characteristics of the subjects and control group are shown in Table 1. Significant difference was not admitted in each item between the two groups.

Insert Table 1

II. Mental State and QOL Evaluation
a) Depression Evaluation

The CES-D results from each measurement period are shown in Table 2. In the pre-surgery evaluation, eight patients (29%) were classed as depressed. At the three-month post-surgery measurement, there was no significant difference in the percentage of people with depression (p = 0.41). In a comparison of pre-surgery and three months post-surgery, CES-D scores were significantly improved (p = 0.01). Among the control group, there is no change between post-surgery and three-month post-surgery scores (p = 0.60). In a comparison of exercise group and control group, there was no significant difference at post-surgery (p = 0.76) and three-month post-surgery period (p = 0.34).

The number of people classed as depressed on the CES-D increased from 10 people (24%) post-surgery to 13 people (33%) three months post-surgery,
indicating that some subjects had developed depression during the three-month period.

**Insert Table 2**

b) QOL Evaluation

The SF-36 results from each measurement period are shown in Table 3. Analysis of variance results showed six subscales (except general health perception and social functioning) to have the greatest effect. Furthermore, a multiple comparison test comparing one month post-surgery and three months post-surgery found that physical functioning, role-physical, role-emotional, and mental health significantly improved at three months post-surgery.

**Insert Table 3**
III. Amount of Physical Activity Evaluation

Compared to the baseline, the two-month average amount of physical activity from one month post-surgery to three months post-surgery significantly increased (p < 0.01). 21 of the 28 subjects reached their individual goals, creating a 75% success rate.

IV. Relationship between Amount of Physical Activity and Questionnaire Scores

The correlation between the average amount of physical activity from one to three months post-surgery and the three-month post-surgery CES-D and SF-36 scores is shown in Figure. There was a negative correlation between physical activity and CES-D scores (p = 0.01). Positive correlations were found between the
amount of physical activity and the scores from the seven subscale items (except bodily pain) of the SF-36.

Discussion

This study investigated whether the introduction of self-administered walking program positively influenced the depressed mental state and QOL of breast cancer patients. Pre-surgery CES-D scores showed that eight out of twenty eight patients (29%) were depressed. Potential changes in mental state are commonly documented in breast cancer patients.

Depression is related to a decreased survival rate in breast cancer patients; research indicates that factors like social support can improve survival rates. It
has also been shown that weight gain during treatment can lead to lowered disease-free survival rate, decreased QOL, and an increased risk of complications. In addition, obesity and decreased physical activity among cancer patients can become risk factors associated with prognoses. Obese breast cancer patients are less physically active than obese women with no history of cancer, while women who exercise a lot have a lower risk of developing breast cancer.

Maintaining a sufficient amount of physical activity, and weight management, are important in preventing breast cancer and improving prognoses. Walking is more convenient method because it is easy to self-monitor the amount of activity and easy to incorporate into daily life.

Although depression is commonly treated with medication and psychological therapy, sometimes exercise therapy is effective for reducing symptoms.
Similarly, many randomized controlled trials indicate that exercise therapy can improve fatigue, physical function, QOL, and mental state in breast cancer patients\textsuperscript{17}.

Previous studies offered various types of exercise therapy without establishing standardized efficacy criteria. In a meta-analysis of randomized controlled trials of breast cancer patients, Carayol et al. found that 12 MET hours/week of mild exercise was most effective in improving fatigue and QOL \textsuperscript{18}. This suggests that strenuous exercise may not necessarily be needed to improve breast cancer patients’ mental state and QOL. In our study, the average amount of physical activity after the introduction of exercise was $12.8 \pm 6.8$ MET hours/week. From these findings, we can consider that walking program is useful for breast cancer patients.
The limitations of our study are small sample size, not randomization, and exercise method. The goals were set according to individual amounts of physical activity, and we aimed to increase the amount of physical activity, and improve its quality by introducing a task-achievement program that asked patients to monitor and record their daily amount of physical activity as shown by the activity monitor, while self-adjusting to meet their goals. This method may lack objectivity and unity. In addition, the control group data was historical and insufficient. To improve the quality of study, we need to improve the exercise method and set the prospective study with sufficient control group.

Breast cancer patients will receive stronger treatment, and it is possible that these patients are experiencing earlier changes in their mental state and decreased QOL and have potentially mental illness. It is necessary to pay
adequate attention to breast cancer patients' mental health, regardless of whether they have a mental illness, and using exercise therapy to maintain mental health and QOL may help to make treatment more effective and improve prognoses.

Conflict of Interest Statement

Makiko Kamio: research grant, Meiji Yasuda Life Foundation of Health and Welfare.
References


Table 1. Patients characteristics

Table 2. The CES-D results from each measurement period

Table 3. The SF-36 results from each measurement period

Figure. Relationship between Amount of Physical Activity and Questionnaire Scores
Table 1. Patients characteristics

<table>
<thead>
<tr>
<th></th>
<th>Exercise patients (n = 28)</th>
<th>Control patients (n = 39)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>51.0 ± 10.1 (38-73)</td>
<td>51.6 ± 8.0 (33-65)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>158.4 ± 5.5 (145-170)</td>
<td>158.1 ± 5.2 (149-168)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>55.4 ± 6.7 (45-67)</td>
<td>54.1 ± 7.4 (38-73)</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>22.1 ± 2.5 (17.6-26.8)</td>
<td>21.7 ± 3.4 (17.1-32.0)</td>
</tr>
<tr>
<td>Menopausal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Premenopausal</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Postmenopausal</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>Disease stage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>I</td>
<td>9</td>
<td>17</td>
</tr>
<tr>
<td>II</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>III</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lumpectomy</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>Mastectomy</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Breast reconstruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>No</td>
<td>23</td>
<td>36</td>
</tr>
<tr>
<td>Adjuvant therapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hormone therapy</td>
<td>18</td>
<td>27</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>Radiation</td>
<td>14</td>
<td>26</td>
</tr>
</tbody>
</table>
Table 2. The CES-D results from each measurement period

<table>
<thead>
<tr>
<th>CES-D score</th>
<th>Exercise patients (n = 28)</th>
<th>Control patients (n = 39)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before surgery</td>
<td>1 month after surgery</td>
</tr>
<tr>
<td>&lt; 16</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>≥ 16</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>11.7 ± 7.3</td>
<td>11.3 ± 7.7</td>
</tr>
</tbody>
</table>
Table 3. The SF-36 results from each measurement period in exercise patients

<table>
<thead>
<tr>
<th>SF-36 subscales</th>
<th>Before surgery</th>
<th>1 month after surgery</th>
<th>3 months after surgery</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical functioning</td>
<td>48.1 ± 10.0</td>
<td>46.4 ± 7.0</td>
<td>50.5 ± 6.4</td>
<td>&lt; 0.05c</td>
</tr>
<tr>
<td>Role-physical</td>
<td>43.4 ± 13.7</td>
<td>34.5 ± 12.8</td>
<td>44.7 ± 10.1</td>
<td>&lt; 0.01ac</td>
</tr>
<tr>
<td>Bodily pain</td>
<td>52.1 ± 10.6</td>
<td>42.4 ± 8.5</td>
<td>46.5 ± 9.5</td>
<td>&lt; 0.01ab</td>
</tr>
<tr>
<td>General health perception</td>
<td>46.5 ± 9.1</td>
<td>46.3 ± 8.7</td>
<td>47.6 ± 8.3</td>
<td>0.39</td>
</tr>
<tr>
<td>Vitality</td>
<td>47.0 ± 11.9</td>
<td>48.9 ± 9.5</td>
<td>52.4 ± 6.8</td>
<td>&lt; 0.05b</td>
</tr>
<tr>
<td>Social functioning</td>
<td>45.3 ± 13.6</td>
<td>40.0 ± 12.4</td>
<td>44.6 ± 12.7</td>
<td>0.11</td>
</tr>
<tr>
<td>Role-emotional</td>
<td>46.4 ± 9.6</td>
<td>43.3 ± 11.2</td>
<td>49.1 ± 7.9</td>
<td>&lt; 0.01c</td>
</tr>
<tr>
<td>Mental health</td>
<td>47.5 ± 10.5</td>
<td>49.4 ± 7.9</td>
<td>55.7 ± 6.2</td>
<td>&lt; 0.01bc</td>
</tr>
</tbody>
</table>

a: Comparison between before surgery and 1 month after surgery

b: Comparison between before surgery and 3 months after surgery

c: Comparison between 1 month and 3 months after surgery