Physical Activity and Psychological Adjustment in Japanese Advanced Lung Cancer Patients in Chemotherapy: The Feasibility of Intervention

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The purpose of this study was to examine the feasibility of a physical activity intervention program and the relationship between physical activity and psychological adjustment in Japanese advanced lung cancer patients in chemotherapy. The study was designed as an intervention study and the sample was comprised of advanced lung cancer patients in chemotherapy, all of whom provided written informed consent. Physical activity was recorded by uniaxial accelerometry monitors (Lifecoder®, Suzuken, Co., Ltd), and psychological adjustment was measured by the Hospital Anxiety and Depression Scale (HADS). Each participant received 1) feedback about the data of their footsteps, 2) positive reinforcement for being physically active, 3) enhancement of autonomy for being physically active and 4) information about setting goals related to physical activity in the first, second, and fourth week. Drop out rate of participants was 33.3% (3/9). None of the variables changed over the four weeks of the study. Spearman’s correlational analysis revealed that higher steps were correlated with lower depression (\( r = -0.90, p < 0.05 \)) at the start of the study. At four weeks, however, higher steps were not correlated with HADS score; similarly, the change of steps had no significant relationship with the change of HADS scores. The results from this study demonstrate that this manner of intervention was less than preferable. The present study partially suggests that high physical activity is related to psychological adjustment in Japanese advanced lung cancer participants in chemotherapy. In order to develop an effective physical activity program, future research should elaborate the method of intervention or increase the control of the variables.

Keywords: foot steps, uniaxial accelerometry, anxiety depression

1. Introduction

Recently, research into the role of exercise in cancer survivors has been analogous to that of examining the role of exercise in cancer prevention (Courneya, 2003). In a framework of oncological rehabilitation, various practices have been used. Blanchard et al. (2004) showed that physical activity may be a key behavior to include in multi-behavioral interventions aimed at improving health-related quality of life (QOL) in cancer survivors. Moreover, cancer diagnosis in adults may have a positive influence on smoking and diet and a negative influence on exercise (Blanchard et al., 2003b); therefore, physical activity may be very important in oncological rehabilitation.
There is growing interest not only in improving insufficient physical conditions, which are actually deteriorating, but also the possible role of exercise in the enhancement of the QOL in cancer survivors (Courneya, 2003). Pinto et al. (2005) demonstrated that energy expenditure increased in early-stage breast cancer patients when they received physical activity counseling.

Courneya (2003) provides an overview of research that has examined exercise in breast cancer survivors. However, research of this kind is lacking in non-breast cancer survivors, and therefore, should be extended to include survivors of other types of cancer. Other important research considerations include rehabilitation for advanced cancer patients experiencing functional decline (Cheville, 2001), and exercise interventions for patients receiving concurrent chemotherapy or radiation therapy (Conn et al., 2006). Further, Friedenreich & Courneya (1996) suggested that studies are needed where the exercise intervention more closely reflects true life circumstances.

Due to an unfavorable prognosis, lung cancer patients make up a preferential cohort for this type of research. Physical health seems important to improving psychological adjustment and QOL among lung cancer patients who have an unfavorable prognosis. Among these individuals, it is desirable to relieve the distress caused by cancer and the side-effects of medication, and to maintain QOL at home. It is reasonable to consider that physical capability might influence the psychological adjustment and daily life of patients who are treated at home. A study of out-patient chemotherapy among lung cancer patients (Hirai et al., 2005) cited “freedom of movement” and “physical strength maintained” as the pros or benefits of out-patient chemotherapy. If relationships between physical activity and psychological adjustment or QOL are demonstrated in lung cancer patients, it would be valuable for lung cancer patients to live appropriately physically active lives at home or in the hospital. We could, therefore, improve the psychological adjustment of lung cancer patients through the development of an intervention program that seeks to increase those patients’ physical activity in a medically tolerable range. It is essential, however, that the feasibility of such an intervention program for lung cancer patients be investigated.

The purpose of this study was to examine the feasibility of an intervention designed to increase the physical activity level in Japanese advanced lung cancer patients in chemotherapy. Establishment of a control period and an intervention period would allow the measurement of changes in the patients’ physical activity and psychological adjustment during each period, and how physical activity was associated with psychological adjustment during each period.

2. Methods

2.1. Participants

Participants were advanced lung cancer patients in chemotherapy admitted to a chest medical center hospital in Osaka, Japan. All participants were without mental disease (e.g. dementia, delirium, schizophrenic disorder) and received a rating of 0, 1, or 2 on the Eastern Cooperative Oncology Group Performance Status (PS: Oken et al., 1982) indicating at least light intensity physical activity was possible. All participants were informed of the aim and method of this study, and their consent was obtained.

2.2. Measure

The number of footsteps was used as the measure of physical activity and was recorded by uniaxial accelerometry monitors (Lifecoder EX®, Suzuken, Co., Ltd, Nagoya, Japan). The Lifecoder EX was validated by a previous study (e.g. Kumahara et al., 2004). The Lifecoder monitors were connected to a personal computer and the test variables, physical activity volume, level, and time per day were extracted. It was thought that if participants knew their physical activity conditions it might encourage them to engage in more physical activity. Psychological adjustment was measured by the Japanese version of Hospital Anxiety and Depression Scale (HADS: Zigmond & Sanith, 1983, 1993). HADS consisted of 14 items measuring anxiety and depression (7 items each). The Japanese version of the M.D. Anderson Symptom Inventory (MDASI-J: Okuyama et al., 2003) was used in this study as a tool to measure the severity of the symptoms experienced as a result of the lung cancer. The first 13 items were designed to
assess the patients’ symptoms during the last 24 hours. The last 6 items measured how many of their symptoms interfered with various aspects of the patient’s life during the past 24 hours. Three different researchers including a medical doctor rated the participants’ physical condition using PS.

In order to identify each participant’s level of physical activity or readiness for physical activity at the time of enrollment, or week 0, each was assigned one of four stages of change derived from the transtheoretical model of change (Prochaska & DiClemente, 1983) based on his or her condition at that time. The four stages used in this study were as follows: precontemplation stage (I currently do not practice physical activity and do not intend to practice physical activity), contemplation stage (I currently do not exercise, but I intend to practice physical activity within the immediate future), preparation stage (I currently practice some physical activity, but not regularly), and action stage (I currently practice physical activity regularly). Demographic data collected included age, sex, BMI, drinking and smoking habit, amount of time spent in the hospital, and the number of family members, including the participant, that are currently living together. Medical data collected included pathology, clinical stage, meta, anti-cancer therapy, and PS.

2.3. Procedure

The study was designed as an intervention study. This research was conducted during November 2004 to July 2005. The participants signed consent forms, answered questionnaires and returned data from the uniaxial accelerometry monitors at the department of rehabilitation in the medical center hospital.

2.3.1. Control period

Initially, all participants received information about the purpose of the research and protection of privacy. After completing the informed consent sheet and the psychological assessment questionnaire, each participant wore the uniaxial accelerometry monitor on the hip during one week, week 1 or the control week, and was instructed to live normally. A researcher filled out the questionnaires for all participants because of the inability to write due to numbness in fingers experienced by a portion of the participants. At the end of week 1, data from each participant’s uniaxial accelerometry monitor was collected as well as feedback from each participant about the events that occurred during that week. This was followed by the completion of the psychological assessment questionnaire.

2.3.2. Intervention period

At the completion of week 1, a structured intervention was implemented intending to enhance physical activity. The intervention period was composed of three time points (the start of the control period is defined as time point 1 or T1): after
week 1 (T2), after week 2 (T3), and after week 4 (T4). Following each psychological assessment during the intervention period, from the researchers of this study, the participants received interventions to enhance their physical activities as follows: 1) feedback about the data of their steps, 2) positive reinforcement for being physically active, 3) enhancement of autonomy for being physically active, and 4) information about setting concrete goals related to physical activity in the T2, T3, and T4 (Figure 1). In particular, participants went over their feedback sheets along with the researcher to confirm their activity during the period. If the participant was active, the researcher positively reinforced the participant and facilitated the recognition of physical and emotional changes. If the participant was not active, the researcher attributed the result to something outside their intension (e.g. the weather or physical condition). To determine activity related to autonomy, the researcher asked about enjoyment associated with being active. With regard to their amount of physical activity, physical condition, and treatment cycles, the participant set approximate future goals with the researcher.

2.4. Statistical analysis

For the analysis, mean steps per 12 hour day were used. If the participant did not collect data for a total of 12 hours on a certain day, the data for that day were substituted with the mean of the total steps from the day before and the total steps from the day after. Non-parametric analyses were used since the study only had six participants. Differences across time were analyzed using the Friedman test, while for Spearman correlations.

3. Results

3.1. Demographic data

Initially, nine individuals were enrolled in the study, and after two weeks, due to the deterioration of medical conditions, three participants dropped out, leaving six participants to complete the study (Table 1). Dropout rate of participants was 33.3% for this study.

3.2. Differences across time

As shown in Table 2, no statistically significant differences were found between the mean steps for each week of the experiment. As shown in Table 3, mean steps varied among the participants. The changes in anxiety and depression scores on the HADS, PS scores, as well as the MDASI-J scores were also not significant.

3.3. Correlational analyses

Spearman correlational analyses revealed a significant relationship between steps and depression at T2 and T3. Mean steps were significantly correlated to PS only at T4 (Table 4).

4. Discussion

The purpose of the present study was to examine 1) the feasibility of the physical activity intervention program, 2) change in patients’ physical activity and the relationships between steps, psychological adjustment, PS, and symptoms were investigated using Spearman correlations.

Table 1  Demographic data and medical information

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Sex</th>
<th>BMI (kg/m²)</th>
<th>Drinking habit</th>
<th>Smoking habit</th>
<th>Pathology</th>
<th>Clinical stage</th>
<th>Meta</th>
<th>Anti-cancer therapy</th>
<th>Performance Status (ECOG: 0 week)</th>
<th>Pain</th>
<th>Stages of change for physical activity</th>
<th>Amount of time required from the home to the hospital (minutes)</th>
<th>Family number living together (including participants)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>48</td>
<td>F</td>
<td>20.5</td>
<td>&lt;3 day/W</td>
<td>—</td>
<td>adeno</td>
<td>IIb</td>
<td>—</td>
<td>chemotherapy</td>
<td>1</td>
<td>—</td>
<td>action 90</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>P2</td>
<td>64</td>
<td>M</td>
<td>22</td>
<td>—</td>
<td>—</td>
<td>small</td>
<td>IV  adrenal</td>
<td>—</td>
<td>chemotherapy</td>
<td>0</td>
<td>—</td>
<td>action 30</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>P4</td>
<td>62</td>
<td>M</td>
<td>16.9</td>
<td>&lt;3 day/W</td>
<td>—</td>
<td>large</td>
<td>IIb</td>
<td>—</td>
<td>chemotherapy</td>
<td>1</td>
<td>—</td>
<td>action 90</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>P7</td>
<td>61</td>
<td>M</td>
<td>20.5</td>
<td>—</td>
<td>—</td>
<td>small</td>
<td>IIb</td>
<td>—</td>
<td>chemotherapy</td>
<td>0</td>
<td>—</td>
<td>action 30</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>P8</td>
<td>67</td>
<td>M</td>
<td>20</td>
<td>—</td>
<td>—</td>
<td>adeno</td>
<td>IIb</td>
<td>—</td>
<td>chemotherapy</td>
<td>0</td>
<td>—</td>
<td>preparation 120</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>P9</td>
<td>64</td>
<td>M</td>
<td>22.1</td>
<td>—</td>
<td>—</td>
<td>squamous</td>
<td>IIb</td>
<td>—</td>
<td>chemotherapy</td>
<td>1</td>
<td>—</td>
<td>action 70</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

mean (SD) 61.00 (6.69) 20.33 (1.89) 71.67 (36.01) 3.00 (1.90)
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Table 2  Mean scores of each variable and the results of Friedman tests

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>χ²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steps</td>
<td>Mean(SD)</td>
<td>Mean(SD)</td>
<td>Mean(SD)</td>
<td>Mean(SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS</td>
<td>0.67(0.52)</td>
<td>1.17(0.75)</td>
<td>0.83(0.41)</td>
<td>0.83(0.75)</td>
<td>1.00</td>
<td>.61</td>
</tr>
<tr>
<td>Anxiety</td>
<td>6.83(3.82)</td>
<td>7.33(4.97)</td>
<td>6.83(5.53)</td>
<td>7.50(6.75)</td>
<td>4.39</td>
<td>.22</td>
</tr>
<tr>
<td>Depression</td>
<td>5.67(4.03)</td>
<td>6.17(4.07)</td>
<td>6.17(5.38)</td>
<td>6.00(6.29)</td>
<td>0.40</td>
<td>.94</td>
</tr>
<tr>
<td>Symptom</td>
<td>1.41(1.37)</td>
<td>2.12(1.08)</td>
<td>2.24(1.65)</td>
<td>2.09(2.68)</td>
<td>0.12</td>
<td>.99</td>
</tr>
<tr>
<td>Symptoms interfered with life</td>
<td>1.03(1.64)</td>
<td>3.14(2.55)</td>
<td>2.50(2.45)</td>
<td>2.00(3.43)</td>
<td>2.28</td>
<td>.52</td>
</tr>
</tbody>
</table>

Note 1: Steps T2 = mean steps of T1-T2; Steps T3 = mean steps of T2-T3; Steps T4 = mean steps of T3-T4
Note 2: All results are not significant.

Table 3  Mean steps of each participant

<table>
<thead>
<tr>
<th>participant</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>9112.86(2449.15)</td>
<td>8011.00(2487.59)</td>
<td>8751.96(3821.71)</td>
</tr>
<tr>
<td>P2</td>
<td>10985.57(2025.37)</td>
<td>12530.57(2807.73)</td>
<td>12013.00(2599.60)</td>
</tr>
<tr>
<td>P4</td>
<td>3226.14(2074.76)</td>
<td>2740.14(834.64)</td>
<td>2570.25(1514.17)</td>
</tr>
<tr>
<td>P7</td>
<td>7625.00(1099.57)</td>
<td>7496.36(1356.33)</td>
<td>6807.00(1517.65)</td>
</tr>
<tr>
<td>P8</td>
<td>7474.71(5059.06)</td>
<td>3811.29(2621.57)</td>
<td>6261.36(2755.89)</td>
</tr>
<tr>
<td>P9</td>
<td>14455.43(3161.97)</td>
<td>15097.71(4402.77)</td>
<td>22624.43(2968.37)</td>
</tr>
</tbody>
</table>

Note: Steps T2 = mean steps of T1-T2; Steps T3 = mean steps of T2-T3; Steps T4 = mean steps of T3-T4

Table 4  Spearman's rank correlation between steps, psychological adjustment, PS, and symptom

<table>
<thead>
<tr>
<th></th>
<th>Steps T2</th>
<th>p</th>
<th>Steps T3</th>
<th>p</th>
<th>Steps T4</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS T2</td>
<td>−0.34</td>
<td>.51</td>
<td>PS T3</td>
<td>−0.39</td>
<td>.44</td>
<td>PS T4</td>
</tr>
<tr>
<td>Anxiety T2</td>
<td>−0.20</td>
<td>.70</td>
<td>Anxiety T3</td>
<td>−0.43</td>
<td>.39</td>
<td>Anxiety T4</td>
</tr>
<tr>
<td>Depression T2</td>
<td>−0.90</td>
<td>.02</td>
<td>Depression T3</td>
<td>−0.84</td>
<td>.04</td>
<td>Depression T4</td>
</tr>
<tr>
<td>Symptom T2</td>
<td>−0.77</td>
<td>.07</td>
<td>Symptom T3</td>
<td>−0.66</td>
<td>.16</td>
<td>Symptom T4</td>
</tr>
<tr>
<td>Symptoms interfered with life T2</td>
<td>−0.37</td>
<td>.47</td>
<td>Symptoms interfered with life T3</td>
<td>−0.75</td>
<td>.08</td>
<td>Symptoms interfered with life T4</td>
</tr>
</tbody>
</table>

Note: Steps T2 = mean steps of T1-T2; Steps T3 = mean steps of T2-T3; Steps T4 = mean steps of T3-T4

psychological adjustment, and 3) the relationship between physical activity and psychological adjustment in Japanese advanced lung cancer patients in chemotherapy. Results from this study suggest a physical activity intervention program for lung cancer patients in chemotherapy is not feasible. This outcome is possibly due to the side effects of the chemotherapy affecting the PS of participants in a negative way.

Due, perhaps, to the small number of participants or the large individual differences, none of the variables changed from the control period to the intervention period by statistical analysis. The most depressed participant reported depression scores ranging from 12 to 15, but a non-depressed participant reported a score from 0 to 3 while in T1 to T4. Some participants (ex. P2 and P9), however, did increase their amount of steps from the control period to the intervention period, suggesting they experienced side effects from the chemotherapy that were milder than other participants.

The fact that physical activity and psychological adjustment did not change at any time point during the study suggests an intervention program aimed at increasing physical activity levels would not improve variables like psychological adjustment, performance status, and cancer symptom severity. Although not significant, most variables changed
between T1 to T4. On one hand, physical activity was related to depression at the two time points in this study indicating a relationship between physical activity and psychological adjustment. This suggests that by altering the variables and the details of the physical activity program a successful intervention design is possible. However, physical activity was not related to anxiety. Relationships between physical activity, anxiety, and depression were similar to a previous study (Arai et al., 2005) applying HADS to a normal population. That study indicated that HADS does not adequately include items that measure physical symptoms.

Two possible confounding factors in this study need to be addressed. First, PS might also be a confounding factor since the PS of some participants could cause abrupt fluctuations in their motor behavior. These factors are the most likely reasons behind the performance status change that led to three participants dropping out of the study. Future studies should also investigate lung cancer patients both before and after surgery or patients that are leaving the hospital and undergoing home care. Second, the uniaxial accelerometry monitors could have influenced the daily activity of the participants during the control period. Similarly, other factors including temperature, weather, day of the week, or the timing of chemotherapy may have impacted the results of this study.

In addition to the limitations mentioned above, the overall research design of this study was complicated and inadequate. Even though a control period was included, the psychological adjustment was measured after the step data feedback was acquired. This acquisition process may have influenced the psychological data as well. Additionally, there were no consistent relationships between variables to lend support to the implementation of a structured intervention. As a consequence of these aforementioned limitations, the results of this study are difficult to explain. This study also had a selection bias. In particular, since participants were in good enough condition to be active, the number of steps at the beginning of this experiment may have been too high to show a significant increase through intervention (ceiling effect). As the participants were already very active at T1, it seems there would be limited room for the effects of psychological improvement.

A future study is planned and will control for factors that were not controlled for in this study. For example, participants will be recruited that have room for improvement in their physical activity level, the sample size will be increased to better analyze factors including PS, therapeutic parameters and period of onset will be better controlled, and setting control group. In particular, controlling the therapeutic situation will help control for factors influencing performance status. Specifically, the next study will investigate the change of physical activity before surgery. Blanchard et al. (2003a) suggested that quality of life was correlated to the change of physical activity volume in cancer survivors after diagnoses rather than their current physical activity volume.

In conclusion, the feasibility of intervention as assessed by this study was not preferable. The present study partially suggests that high physical activity is related to psychological adjustment in Japanese advanced lung cancer participants in chemotherapy. In order to develop an effective physical activity program, future research should elaborate the method of intervention or increase the control of the variables.

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References


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