# Fatigue and Depression in Patients With Lymphoma Undergoing Autologous Peripheral Blood Stem Cell Transplantation

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**Purpose/Objectives:** To describe the patterns of depression and fatigue, including its dimensions, and the relationship between these two variables in patients with lymphoma undergoing autologous peripheral blood stem cell transplantation (PBSCT).

**Design:** Prospective, descriptive, correlational, repeated measures.

**Setting:** Midwestern university National Cancer Institute-designated clinical cancer center.

**Sample:** 27 patients with lymphoma aged 19–71 undergoing autologous PBSCT.

**Methods:** The revised Piper Fatigue Scale was used to measure fatigue and its dimensions. The Center for Epidemiologic Studies–Depression Scale was used to measure depression on selected days at baseline and during chemotherapy and recovery.

**Main Research Variables:** Fatigue and its four dimensions (behavioral/severity, sensory, cognitive/mood, and affective meaning) and depression.

**Findings:** Total fatigue, fatigue's four dimension scores, and depression scores changed significantly over time, with the highest scores at day +7 after transplant. Total fatigue and the four dimension scores were highly and positively correlated with depression, with the highest correlation reported between the affective fatigue dimension and depression.

**Conclusions:** The findings support the importance of assessing fatigue and depression in patients undergoing autologous PBSCT at baseline, during chemotherapy, and throughout recovery.

**Implications for Nursing:** Routine clinical assessment with close observation around day +7 after transplant and patient education about the patterns of fatigue and depression will help the healthcare team to intervene at the appropriate time and may help patients to better manage these symptoms.

## Key Points . . .

- Little is known about the patterns of fatigue and its four dimensions or depression in patients undergoing autologous peripheral blood stem cell transplantation.
- Assessment of fatigue and depression is important and should be ongoing.
- Patients' fatigue and depression peak in the immediate recovery period (day +7 after transplant).

The American Cancer Society estimated that 62,250 new cases of lymphoma will be diagnosed in the United States in 2004; of these, 7,880 will be Hodgkin disease and 54,370 will be non-Hodgkin lymphoma (Jemal et al., 2004). In 2000, the last year for which the estimated number of patients with lymphoma who underwent autologous peripheral stem cell or bone marrow transplantation (BMT) in North America is available, 4,500 of the 11,000 autologous transplants for all kinds of cancer were done for lymphomas (International Bone Marrow Transplant Registry/Autologous Blood and Bone Marrow Transplant Registry, 2002). Many patients who receive ablative therapy as a preparation for transplantation are troubled by the side effects associated with this treatment. Fatigue and depression are among the most significant treatment side effects.

Although fatigue has been studied, most of these studies have been conducted on patients receiving standard-dose chemotherapy, not those undergoing stem cell or BMTs (Hann et al., 1999). However, these related studies support the linking

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of fatigue, high-dose chemotherapy, and transplantation because 90% of patients with breast cancer who completed chemotherapy and were scheduled for transplantation reported fatigue (Gaston-Johansson, Ohly, Fall-Dickson, Nanda, & Kennedy, 1999). The importance of this problem is underscored by the 80%–100% prevalence rate of fatigue in patients undergoing standard chemotherapy (Irvine, Vincent, Bubela, Thompson, & Graydon, 1991; Piper, 1993; Winningham et al., 1994). In 379 patients who had undergone chemotherapy, 75% had to change their employment status because of fatigue (Curt, 2000; Curt et al., 2000). On average, patients reported missing almost a full week of work (4.2 days) during a typical month, but the cost of fatigue can be demonstrated not only by missing work. Fifty percent of the surveyed patients reported needing help for everyday duties such as household cleaning or child care.

Depression has been estimated to occur in 20%–25% of patients with cancer (Bottomley, 1998b; Ibbotson, Maguire, Selby, Priestman, & Wallace, 1994). Depressed patients who are medically ill and hospitalized are estimated to have a 40% longer median length of hospital stay and 35% greater mean hospital costs compared with patients who are not depressed (Levenson, Hamer, & Rossiter, 1990).

Fatigue is a phenomenon that is expected to accompany cancer treatment. Because fatigue has a pattern over time, it should be measured longitudinally (i.e., before, during, and after treatment) (Nail, 2002; Nail & King, 1987). Healthcare professionals also need to understand the frequency, intensity, and distress of depression associated with such intensive treatment in patients with cancer and adequately treat this symptom (Bottomley, 1998a; Hjermstad et al., 1999).

The purpose of this study was to describe the patterns of fatigue and its dimensions and of depression and the relationship between these two variables in patients with lymphoma undergoing autologous peripheral blood stem cell transplantation (PBSCT). The following research questions were addressed.

1. How do fatigue and its dimensions (behavioral/severity, sensory, cognitive/mood, and affective meaning) and depression change over time in patients undergoing autologous PBSCT on selected days of measurement during three time periods: baseline (prior to chemotherapy initiation), chemotherapy (two days before transplant [day –2]), and recovery (two days after transplant [day +2], seven days after transplant [day +7], and 14 days after transplant [day +14])?
2. What is the relationship between fatigue and its dimensions and depression in these patients?

## Literature Review

### Fatigue

Fatigue is one of the most frequent, bothersome, and persistent complaints of patients with cancer during the treatment and recovery periods (Cella, 1997; Cella, Lai, Chang, Peterman, & Slavin, 2002; Cella, Peterman, Passik, Jacobsen, & Breitbart, 1998; Holley, 2000; Richardson, 1995; Stone et al., 2000; Winningham & Barton-Burke, 2000) and can impair daily functioning and lead to negative effects on quality of life (Irvine, Vincent, Graydon, Bubela, & Thompson, 1994). Despite the significant problem of fatigue in patients with cancer, it remains one of the least studied symptoms of cancer treatment (Berger, 2001). Fatigue is a complex, multicausal, multidimensional, and poorly understood phenomenon (Aaronson et al., 1999; Glaus, 1993; Knobel et al., 2000; Nail, 2002; Ream & Richardson, 1996; Winningham et al., 1994).

Fatigue has been reported to peak a few days after chemotherapy and to show different patterns with different chemotherapy protocols. In 12 patients with ovarian cancer who received chemotherapy, fatigue was reported to peak at day +7 and decline during the remainder of the 28-day treatment course (Pickard-Holly, 1991). Richardson, Ream, and Wilson-Barnett (1998) studied fatigue in patients with breast, small cell lung, and ovarian cancer who received different protocols of chemotherapy. Patients recorded their fatigue daily in a diary. In patients with breast cancer, fatigue remained high in the first 14 days and peaked after day +8. For patients with small cell lung cancer, fatigue started to decline after day +1 and then increased around days +5 to +7. Fatigue in patients with ovarian cancer remained high during the first five days and then began to decline, followed by increases in fatigue around days +13 through +15 and +20 through +21.

Little research has been conducted to measure fatigue dimensions or the patterns of fatigue dimensions over time. In a study of patients with breast cancer, after completing chemotherapy and before transplantation, fatigue was measured by an early version of Piper Fatigue Scale (PFS) (42 items). Total fatigue and the four dimension scores in a descending order were temporal dimension ($\overline{X}$ = 35.2, range = 0–79), sensory dimension ($\overline{X}$ = 36.52, range = 0–88), affective meaning ($\overline{X}$ = 34.38, range = 0–92), total fatigue ($\overline{X}$ = 31.26, range = 0–87), and intensity/severity dimension ($\overline{X}$ = 20.76, range = 0–74) (Gaston-Johansson, Fall-Dickson, Bakos, & Kennedy, 1999).

Berger (1998) studied a sample of 72 women receiving adjuvant chemotherapy after surgery for stage I or II breast cancer. Fatigue was measured using the revised 22-item PFS at six data collection times, 48 hours after each of three treatments, and at these same treatment cycle midpoints. Fatigue and dimension scores were significantly different over time, with scores higher at treatment times and lower at cycle midpoints. The highest levels of total fatigue and dimension scores (except affective meaning) were reported at the first chemotherapy treatment. Affective meaning scores were highest at the third chemotherapy treatment.

Another study by Dean (2002) examined women with breast cancer (stage 0–III) who had completed tumor removal (lumpectomy or mastectomy). Total and dimension PFS scores increased postoperatively compared to preoperatively with the exception of the affective meaning dimension that decreased postoperatively. However, changes were not significant. The sensory dimension was reported the highest pre- and postoperatively.

### Depression

Depression is a significant symptom that occurs secondary to a medical illness and is common in patients with different types of cancer (Andrykowski, Curran, & Lightner, 1998; Mock et al., 1997). Several studies have focused on psychological problems associated with patients undergoing BMT and have shown that these patients experience depression (Gaston-Johansson & Foxall, 1996; Gaston-Johansson, Franco, & Zimmerman, 1992; Hjermstad et al., 1999; Molassiotis,

Boughton, Burgoyne, & van den Akker, 1995; Molassiotis & Morris, 1999; Syrjala, Chapko, Vitaliano, Cummings, & Sullivan, 1993; Wolcott, Fawzy, & Wellisch, 1986). In one of the few studies that examined depression in patients undergoing high-dose chemotherapy, Leigh, Wilson, Burns, and Clark (1995) assessed 36 patients for depression prior to BMT, at three to five months, and again six to nine months following BMT. These results showed that 19% of the patients were diagnosed with depressive illness before transplantation, 31% were depressed three to five months after transplantation, and 19% still were depressed six to nine months after transplantation.

Results of other studies of depression in BMT recipients have been inconsistent. In a study by Gaston-Johansson et al. (1992), depression was measured two days before BMT and 5, 10, and 20 days after BMT in 17 patients with Hodgkin lymphoma. Mean scores of depression at these times on the Beck Depression Inventory (BDI) were 16.41, 21.70, 17.23, and 14.50, respectively. Total BDI scores are classified as normal (0–9), mild depression (10–15), moderate depression (16–23), or severe depression (24–63). Patients reported significantly more depression on day +5 than on any other day ($F = 2.81$, $p < 0.05$). In a later study, depression was measured in 4 patients with Hodgkin lymphoma and 20 patients with non-Hodgkin lymphoma at 14 days and 2 days before BMT and 5 and 20 days after BMT (Gaston-Johansson & Foxall, 1996). Mean scores of depression on the BDI at these times were 9.7, 8.5, 8.4, and 5.9, respectively, indicating that patients reported the highest scores of depression at two weeks before transplantation and not at day +5, as reported by Gaston-Johansson et al. (1992).

In a longitudinal study of 63 patients receiving peripheral stem cell or BMT, depression scores on the BDI were found to be low before transplantation ($\overline{X} = 7.25$, SD = 4.88) (Schulz-Kindermann, Hennings, Ramm, Zander, & Hasenbring, 2002). Three patients recorded their depression at the clinical level. Depression levels were measured weekly during the first three weeks after transplantation. However, no significant changes in depression levels were noted in these three patients over time.

Hjermstad et al. (1999) measured depression using the Hospital Anxiety and Depression Scale (HADS) in patients undergoing allogeneic or autologous PBSCT and in patients with lymphoma undergoing standard-dose chemotherapy. Depression is classified on the HADS as normal (0–7), mild (8–10), moderate (11–14), or severe (15–21). No significant statistical differences were found in depression across the three groups; however, patients undergoing autologous PBSCT had slightly higher mean depression scores than patients undergoing allogeneic transplants. Depression levels increased from one month prior to transplant to two weeks after transplant in both groups (2.8–6.1 for allogeneic and 3.9–6.4 for autologous).

Depression was correlated with fatigue in 263 patients undergoing standard-dose chemotherapy ($r = 0.43$, $p < 0.001$) (Redeker, Lev, & Ruggiero, 2000) and in patients with breast cancer scheduled for transplantation ($r = 0.58$, $p < 0.001$) (Gaston-Johansson, Fall-Dickson, et al., 1999). The highest correlations of depression scores in this study were with the intensity/severity and sensory dimensions of fatigue. A similar correlation was observed between fatigue and depression ($r = 0.61$, $p < 0.001$) in women with breast cancer during radiation therapy (Mock et al., 1997), but no relationship was found in patients with ovarian cancer (Pickard-Holly, 1991). No strong evidence for a cause-and-effect relationship between both symptoms has been found to date (Visser & Smets, 1998).

The literature demonstrates varying incidence rates and levels of fatigue among cancer populations. Most of the studies have been conducted in patients who were receiving standard-dose chemotherapy. Few studies have focused on patients with lymphoma undergoing autologous PBSCT who receive high-dose chemotherapy. In addition, examination of the patterns of multiple symptoms in this population is lacking (Dodd et al., 2001). The prevalence of depression in patients with cancer varies according to the setting (Valentine & Meyers, 2001); however, the incidence of major depression in patients with cancer has been reported to be two to three times greater than the general population (Pirl & Roth, 1999). Because of inconsistencies in the results of previous studies on patients with cancer, the relationship between fatigue and depression should be reexamined.

## Conceptual Framework

Piper's Integrated Fatigue Model (IFM) in healthy and clinical populations was chosen to guide this study (Piper, 1993, 1998; Piper, Lindsey, & Dodd, 1987). The IFM includes fatigue and its four dimensions and identifies 14 factors (patterns) proposed to influence fatigue. In this study, depression was the selected factor under the psychological patterns that was examined as a possible influence or correlate with fatigue and its dimensions.

## Methods

### Sample and Setting

The study's subjects were recruited from a transplant unit in a midwestern university National Cancer Institute-designated clinical cancer center. While undergoing chemotherapy, transplantation, and recovery, the patients in this center reside in a hotel-like suite in a cooperative care setting with a designated caregiver who is a member of the patient's family or a friend. Patients are in close contact with nurses and other healthcare team members. Cooperative care is an approach that allows patients and their caregivers to play an active role in the treatment and recovery process following transplantation. Caregivers assist in all aspects of the recovery process, including administering medications, monitoring health changes, and attending informational sessions (Schmit-Pokorny, Franco, Frappier, & Vyhlidal, 2003). Twenty-seven patients with lymphoma who underwent autologous PBSCT agreed to participate, and an institutional review board approved the study.

### Design, Data Collection, and Procedures

This study is a prospective, descriptive, correlational, and repeated measures design. Data were collected during three time periods on five different days: baseline (before chemotherapy initiation), chemotherapy (day –2), and recovery (day +2, day +7, and day +14). Patients were given the data collection instruments and taught how to use them to report their depression and fatigue on each of the five data-collection days. Instruments were returned following each day of data collection to prevent subjects from reviewing their previous responses. To standardize fatigue scores, which varied within a 24-hour day,

**Table 1. Demographic Characteristics of the Sample**

| Characteristic | n | % |
|---|---|---|
| **Age (years)** | | |
| $\bar{X}$ = 49 | – | – |
| SD = ±13.706 | – | – |
| Range = 19–71 | – | – |
| **Gender** | | |
| Male | 15 | 56 |
| Female | 12 | 44 |
| **Diagnosis** | | |
| Non-Hodgkin lymphoma | 24 | 89 |
| Hodgkin lymphoma | 3 | 11 |
| **Treatment protocol** | | |
| BEAM | 24 | 89 |
| BEAM with rituximab | 3 | 11 |

N = 27

BEAM—chemotherapy protocol consisting of carmustine, etoposide, cytosine arabinoside, and melphalan

patients were instructed to score their fatigue during a four-hour period from 2–6 pm. This time range was chosen because it approximates the midpoint of the usual sleep/wake cycle. Also, the severity of fatigue varies throughout the day, and fatigue occurs more frequently in the afternoon and early evening (Richardson et al., 1998).

## Instruments

Fatigue was measured using the revised **PFS** (Piper et al., 1989, 1998). The PFS was the first instrument used to measure the subjective multidimensions of cancer-related fatigue (Piper et al., 1989). The PFS has 27 items in three sections. The first section has one item referring to the length of time an individual has experienced fatigue. The second section includes 22 items categorized in four dimensions: behavioral/severity (6 items), sensory (5 items), cognitive/mood (6 items), and affective meaning (5 items). Scores for each item range from 0–10, with word anchors that vary from the generic (none to a great deal) to the specific (able to concentrate to unable to concentrate). The sum of the total items ranges from 0–220. A mean score is obtained by dividing the sum of all scores by 22, with higher scores indicating higher perceived fatigue. The third section consists of four open-ended questions about perceived cause, effect, and associated symptoms of fatigue; however, answers to these four questions are not reported here.

The validity of the PFS was established on the original 42-item scale. Face and content validity were determined by a literature review and evaluation by an 11-member national fatigue expert panel (Piper et al., 1989). Concurrent validity was established by a correlation of different fatigue scales, including a fatigue symptom checklist and the Profile of Mood States. Moderate discriminant and convergent validity were found.

Tool reliability and validity have been documented in patients with cancer (Berger, 1998; Piper, 1998). Standardized Cronbach's alpha for the 22-item scale in a sample of female breast cancer survivors was 0.97, indicating excellent reliability (Piper et al., 1998). Cronbach's alpha for the four dimensions in patients undergoing autologous stem cell or BMT ranged from 0.83–0.98 (Gaston-Johansson, Fall-Dickson, et al., 1999). The PFS can be completed in approximately 5–10 minutes.

**Table 2. Friedman's Repeated Measures Analysis of Variance on Ranks of Patterns of Fatigue and Its Dimensions and Depression**

| Variable | Baseline | Day –2 | Day +2 | Day +7 | Day +14 | $c^2$ | p |
|---|---|---|---|---|---|---|---|
| **Piper Fatigue Scale total** | | | | | | | |
| $\bar{X}$ | 4.070 | 3.920 | 5.840 | 6.720 | 5.120 | | |
| SE | 0.461 | 0.505 | 0.502 | 0.523 | 0.623 | 20.880 | < 0.001 |
| n | 26 | 23 | 18 | 20 | 15 | | |
| **Behavioral/severity** | | | | | | | |
| $\bar{X}$ | 3.640 | 3.300 | 5.580 | 6.880 | 5.370 | | |
| SE | 0.547 | 0.573 | 0.665 | 0.646 | 0.730 | 17.273 | 0.002 |
| n | 26 | 23 | 18 | 20 | 15 | | |
| **Sensory** | | | | | | | |
| $\bar{X}$ | 4.760 | 4.600 | 7.170 | 7.520 | 5.750 | | |
| SE | 0.546 | 0.561 | 0.501 | 0.577 | 0.692 | 14.828 | 0.005 |
| n | 26 | 23 | 18 | 20 | 15 | | |
| **Cognitive/mood** | | | | | | | |
| $\bar{X}$ | 3.920 | 3.920 | 5.060 | 6.280 | 4.120 | | |
| SE | 0.394 | 0.434 | 0.483 | 0.471 | 0.511 | 12.195 | 0.016 |
| n | 26 | 23 | 18 | 20 | 15 | | |
| **Affective** | | | | | | | |
| $\bar{X}$ | 4.060 | 3.990 | 5.78 | 6.270 | 5.400 | | |
| SE | 0.590 | 0.659 | 0.632 | 0.629 | 0.777 | 14.400 | 0.006 |
| n | 26 | 23 | 18 | 20 | 15 | | |
| **Depression** | | | | | | | |
| $\bar{X}$ | 13.110 | 12.950 | 16.640 | 21.800 | 15.130 | | |
| SE | 1.687 | 1.864 | 2.524 | 1.785 | 2.002 | 15.618 | 0.004 |
| n | 27 | 21 | 11 | 20 | 15 | | |

SE—standard error

*Note.* Some patients did not complete the scale for all time points.

Depression was measured using the **Center for Epidemiologic Studies–Depression (CES-D) Scale** (Okun, Stein, Bauman, & Silver, 1996). The CES-D, which is among the most widely used questionnaires for depression screening, contains 20 items associated with depression and assesses only current symptomatology. Subjects are asked to rate the frequency of each symptom over the prior week. Scores range from 0 (rarely or none of the time) to 3 (most or all of the time). Four items (4, 8, 12, and 16) are worded as positive symptoms and are reverse coded. Total scores range from 0 (no depression) to 60 (severe depression). A score of 16 or more is indicative of depressive symptomatology (Vahle, Andresen, & Hagglund, 2000).

The CES-D has been administered to a wide variety of populations, including patients undergoing peripheral stem cell or BMT (McQuellon et al., 1998). In the developmental stage, the CES-D was sent to 2,846 participants and mailed again for a retest. This instrument showed a high internal consistency (r = 0.85–0.90) and good test-retest reliability (r = 0.51–0.67) at two, four, six, and eight weeks (Radloff, 1977). The CES-D can be completed in less than seven minutes.

# Results

Most of this study's subjects were middle-aged men with non-Hodgkin lymphoma. All were Caucasian (see Table 1).

## Patterns of Fatigue

The mean total fatigue score and the four dimension scores are reported in Table 2. These results indicate that all scores increased sharply and peaked at day +7 as illustrated in the profile plot (see Figure 1). The sensory dimension was the highest score at day +7. Friedman's repeated measures analysis of variance (RM-ANOVA) on ranks was used to analyze the data for changes in total fatigue and the four dimensions over time because of the difficulty in testing the assumptions of parametric RM-ANOVA with the small number of patients who had completed all time points of data collection. A significant difference existed over time in total fatigue and the four dimension scores. The Tukey test (see Table 3) was used as a conservative test for pairwise comparisons to control the errors of all comparisons simultaneously. Total fatigue and the four dimension scores increased from baseline to day +7, and these increases were significant in all dimensions except for the cognitive dimension.

## Patterns of Depression

Depression scores increased sharply and peaked at day +7 as shown in Figure 2. The mean depression scores are displayed in Table 2. Friedman's RM-ANOVA on ranks showed a significant change in depression scores over time. Depression scores increased from baseline to day +7, and then patients reported a significant decrease in their depression from day +7 to day +14.

Total fatigue and the four dimension scores reported by subjects who completed all data collection points were highly and positively correlated with depression. The Spearman correlation ranged from 0.842–0.929 ($p < 0.01$) (see Table 4). The highest reported correlation was between affective fatigue and depression ($r = 0.929$, $p = 0.001$).

# Discussion

Prior to discussion of the results, several limitations of this study should be noted. They include a small convenience sample size (N = 27), collection of the data from one location, and many missing data points. High levels of fatigue or depression may have influenced participation in the study and the completeness of the data that were reported. Therefore, caution should be exercised when generalizing the results of this study to all patients with lymphoma undergoing autologous PBSCT.

One of the most significant findings related to fatigue was that the greatest reported fatigue occurred on day +7. This was expected and was similar to Richardson et al.'s (1998) findings in patients with breast cancer when fatigue was found to peak at the nadir (lowest leukocyte count) after day +8 and in patients with small cell lung cancer, whose fatigue increased around days +5 through +7. The second important finding was that the sensory dimension had the highest day +7 score, which is similar to Dean, Sarna, and Grant's (2001) study results. The affective fatigue dimension in this study followed the same pattern of total and other dimensions of fatigue. This pattern is in

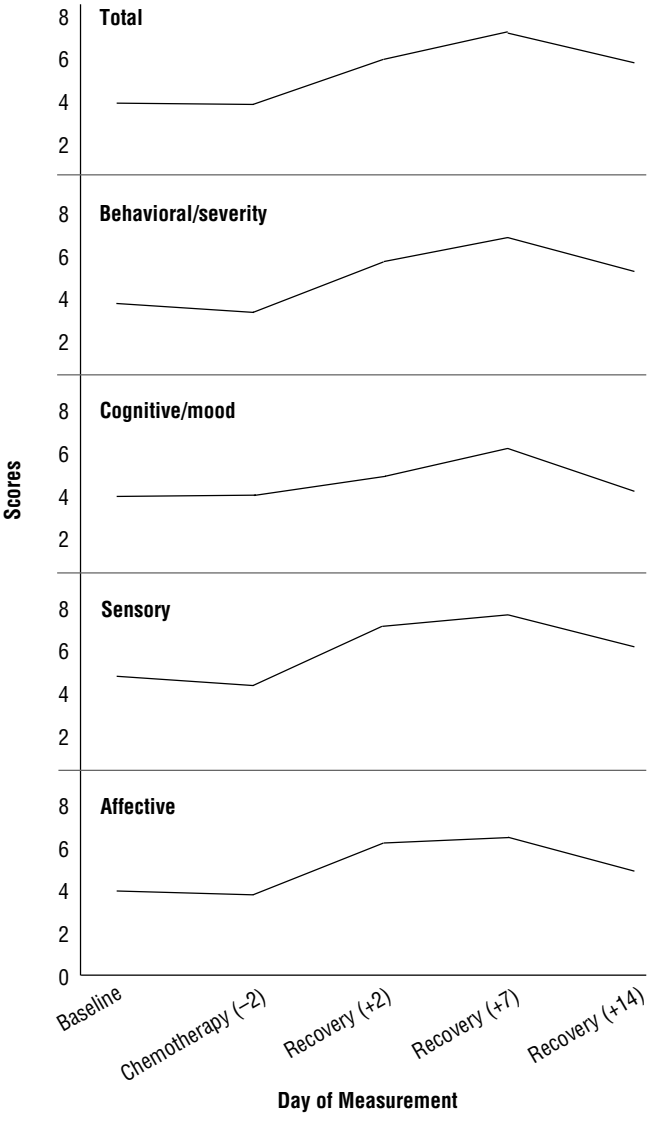


**Figure 1. Piper Fatigue Scale Total and Four Dimensions: Change Over Time**

**Table 3. Pairwise Multiple Comparisons (Tukey Test)**

| Scale | Day +14 Versus Baseline | Day +7 Versus Baseline | Day +7 Versus Day –2 | Day +7 Versus Day +2 | Day +7 Versus Day +14 | Day +2 Versus Baseline | Day +2 Versus Day –2 | Day +2 Versus Day +14 | Day –2 Versus Baseline | Day –2 Versus Day +14 |
|---|---|---|---|---|---|---|---|---|---|---|
| Piper Fatigue Scale total | 3.00 | 6.00* | 4.20* | 1.80 | 3.00 | 4.20* | 2.40 | 1.20 | 1.80 | 1.20 |
| Behavioral/severity | 3.20 | 4.80* | 3.90* | 0.70 | 1.60 | 4.10* | 3.20 | 0.90 | 0.90 | 2.30 |
| Sensory | 1.30 | 4.50* | 3.80 | 1.00 | 3.20 | 3.50 | 2.80 | 2.20 | 0.70 | 0.60 |
| Cognitive/mood | 0.00 | 3.80 | 2.10 | 3.80 | 3.80 | 1.70 | 1.70 | 1.70 | 0.00 | 0.00 |
| Affective | 3.60 | 4.40* | 2.30 | 0.00 | 0.80 | 4.40* | 2.30 | 0.80 | 2.10 | 1.50 |
| Depression | 0.78 | 5.03* | 3.47 | 2.35 | 4.25* | 2.68 | 1.12 | 1.90 | 1.57 | 0.78 |

*$p < 0.05$

contrast to the findings of Berger (1998) and Dean et al. who determined that the affective fatigue dimension's pattern was different than the other dimensions. Although the previous studies were not performed on patients undergoing transplants, they did receive standard chemotherapy or underwent surgery for cancer.

Another important finding was that depression followed the same pattern of fatigue, with the highest level occurring at day +7. Depression is expected in these patients because they are undergoing a life-threatening procedure. CES-D scores were greater than 16 two and seven days after transplant, which is indicative of major depression (Vahle et al., 2000). These results were somewhat consistent with an earlier study of patients with Hodgkin disease undergoing BMT in which depression peaked five days after transplantation (Gaston-Johansson et al., 1992).

The highest correlation was reported between affective fatigue and depression. However, this contradicts Gaston-Johansson, Fall-Dickson, et al.'s (1999) findings that the highest correlations were among intensity and sensory fatigue and depression.

## Nursing Implications

Findings of this study suggest that at day +7 after autologous PBSCT, patients have the most fatigue and depression. Nurses should be observant and assess for these symptoms before, during, and after transplant with special attention around day +7 after transplant to plan and design appropriate interventions. Around day +7, nurses may plan to balance patients' activity to conserve energy in an effort to decrease fatigue. Nurses should remember that if fatigue is detected early (i.e., before or during chemotherapy) and interventions initiated, patients' fatigue may be lessened at day +7. Routine assessment of fatigue and depression will help patients to understand the pattern of their symptoms during the course of transplantation. Teaching patients that the peak of these symptoms approximately seven days after transplant is an expected finding may help to ease their concern that their condition is taking an unexpected negative turn. Nurses should educate and encourage patients to report these symptoms to the healthcare team immediately. In addition, standardized short tools should be incorporated in the clinical setting to measure symptoms at appropriate time intervals (e.g., using a single-item visual analog scale for fatigue daily and the short version of the CES-D weekly).

This is considered a pilot study; therefore, additional data should be collected. Future research in this area may include a decreased number of data collection points because multiple data collection points may tire patients. The results of this study could lead to the development of pharmacologic and nonpharmacologic interventions that could be tested in future studies to decrease fatigue and depression.

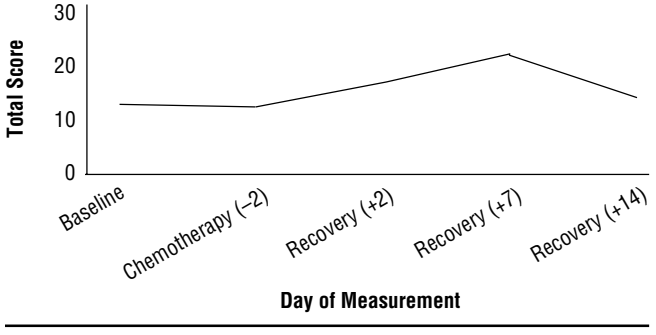


**Figure 2. Center for Epidemiologic Studies-Depression Scale: Change Over Time**

## Summary

Fatigue commonly has been reported as a side effect of high-dose cancer treatment, which has been confirmed by the results of this study. Patients experienced fatigue before transplantation, during chemotherapy, and in the recovery periods. A pattern of fatigue showed a marked increase seven days after transplantation that began to decrease 14 days after transplantation.

Quality care for patients undergoing transplantation requires a multidisciplinary team that works to enhance quality of life. The period of transplantation is a challenging time for

**Table 4. Correlations Between Fatigue and Depression**

| | Piper Fatigue Scale | | | | |
|---|---|---|---|---|---|
| Depression | Total | Behavioral/ Severity | Sensory | Cognitive/ Mood | Affective |
| r | 0.922 | 0.898 | 0.851 | 0.842 | 0.929 |
| p | 0.001 | 0.002 | 0.007 | 0.009 | 0.001 |

*Note.* Only eight patients completed all time points.

patients physically and psychologically. Advancements in the autologous PBSCT process in recent years nearly have eliminated the mortality associated with this procedure, but patients still are suffering from significant adverse effects such as fatigue and depression. Identifying the relationship between fatigue and depression in patients undergoing autologous PBSCT is the first step in attempting to ease the adverse effects of these major symptoms.

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