The Effect of the Neutropenic Diet in the Outpatient Setting: A Pilot Study

Debra DeMille, MS, RD, LDN, Priscilla Deming, MSN, RN, Paul Lupinacci, PhD, and Linda A. Jacobs, PhD, RN

Purpose/Objectives: To determine whether use of the neutropenic diet in the outpatient setting decreases the number of febrile admissions and positive blood cultures associated with chemotherapy-induced neutropenia.

Design: Descriptive pilot study.

Setting: Outpatient chemotherapy unit of a medical center in a major metropolitan area.

Sample: Convenience sample of 28 patients aged 33–67 years beginning treatment with 1 of 13 chemotherapy regimens.

Methods: Twelve-week prospective study beginning on day 1 of chemotherapy cycle 1. Patients received instructions regarding the neutropenic diet before starting chemotherapy. Adherence assessment telephone calls were made at weeks 6 and 12. Hospital admission charts were reviewed at study completion.

Main Research Variables: Adherence with neutropenic diet, number of febrile admissions, and number of positive blood cultures.

Findings: Sixteen patients were compliant with the neutropenic diet, four of which were admitted for neutropenia with gram-negative rods. No significant differences were found in the rates of febrile admissions or positive blood cultures between compliant and noncompliant patients.

Conclusions: Clinical significance in this pilot study is related to the time required for diet education, content of diet education regarding food restrictions, and difficulty adhering to diet requirements given the multitude of side effects (e.g., nausea, vomiting, mouth sores, diarrhea) of chemotherapy.

Implications for Nursing: No clear evidence exists that the neutropenic diet makes a difference in overall rates of infection. Nursing research to compare the neutropenic diet with a less restrictive food safety education-focused diet is needed to guide clinical practice.

Key Points . . .

- The role of the neutropenic diet in preventing infections in patients receiving chemotherapy is controversial.
- No standard definition of the neutropenic diet exists.
- Further evidence-based study is necessary to determine the most effective dietary approach for neutropenia and avoid unnecessary dietary restrictions.

Cancer treatment has evolved, and a majority of chemotherapy regimens now are administered in the outpatient setting. The advent of high-technology homecare, growth factors, and improved antibiotic therapy have contributed to the transition. In-depth patient education related to chemotherapy drugs, schedules, and potential side effects as well as diligent postchemotherapy symptom management are significant components of the chemotherapy process. The goals of these practices are to prevent or minimize side effects experienced by patients receiving chemotherapy and aggressively manage symptoms as they occur.

One major side effect of chemotherapy is the development of infection as a result of neutropenia, or lowering of the white blood cell count that results from damage to the bone marrow and severe marrow suppression. The most important value to monitor is the number of bacteria-fighting blood cells (i.e., neutrophils), referred to as the absolute neutrophil count (ANC). Most patients with an ANC higher than 500 per cubic millimeter (mm^3) of blood do not develop major infections. Once the ANC drops below 500/mm^3, the chance of developing an infection increases significantly. When ANC values are higher than 1,000/mm^3, infection risk is reduced significantly (Baehner, 2004). Variation among patients is common, however, and although some patients with ANCs far above 500/mm^3 will develop infections, others with ANCs below 500/mm^3 will remain infection-free.

Neutropenia occurs in many patients undergoing outpatient chemotherapy and is the most significant risk factor identified in patients with infections. Patients' risk of infection is related to the severity and duration of neutropenia (Brandt, 1990; Carter, 1993; Gaytan-Martinez et al., 2000; Greifzu, 1991; Pizzo, 1984). The white blood cell count is at its lowest point (i.e., nadir) within 10–14 days of beginning chemotherapy.

Debra DeMille, MS, RD, LDN, is a nutrition counselor in the Joan Karnell Cancer Center at the Pennsylvania Hospital and Priscilla Deming, MSN, RN, is an oncology clinical nurse specialist in the Department of Hematology-Oncology at the Hospital of the University of Pennsylvania, both in Philadelphia; Paul Lupinacci, PhD, is an assistant professor of statistics in the Department of Mathematical Sciences at Villanova University in Pennsylvania; and Linda A. Jacobs, PhD, RN, is the director of the Lance Armstrong Foundation Living Well After Cancer Program in the Abramson Cancer Center at the Hospital of the University of Pennsylvania. *The research for this article was funded by the ONS Foundation through an unrestricted grant from Amgen Inc. (Submitted July 2004. Accepted for publication March 17, 2005.)*

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At that point, patients are most susceptible to infection, and prevention is of great importance.

The role of the neutropenic diet in preventing infections in patients receiving chemotherapy is controversial. The theory behind the practice is to prevent patients from ingesting potential pathogens found on food sources, thereby preventing infections resulting from ingesting the organisms. Studies have identified gram-negative organisms such as *Pseudomonas aeruginosa, Escherichia coli, Klebsiella,* and *Proteus* on a variety of foods (Moe, 1990; Shooter, Cooke, Faiers, Breaden, & O'Farrell, 1971; Shooter et al., 1969). The concern is that bacteria will pass through the gastrointestinal tract into the blood stream, lymph nodes, or other organs, causing serious infection (Carter, 1994).

Background

In the outpatient setting, many nurses include detailed information about the neutropenic diet when instructing patients undergoing chemotherapy. The purpose of instructing patients about the neutropenic diet is to prevent infections by limiting patients' exposure to food-borne pathogens, with the rationale that patients with compromised immune systems are more susceptible to those types of infections. The healthcare literature advises providers and patients to make a variety of restrictive dietary changes as a way to prevent infections (Fishman & Mrozek-Orlowski, 1999; McCallum & Polisena, 2000; Weihofen & Marino, 1998). Greifzu (1991) included recommendations to monitor nutritional status and to advise patients not to eat raw vegetables or fruits if their ANC is lower than 500/mm^3. Brandt (1990) recommended a low microbial neutropenic diet consisting of only cooked foods for neutropenic patients. Carter (1994) proposed nutritional protection for neutropenic patients by eating low-bacteria and cooked foods during the treatment process.

The neutropenic diet also has been referred to in the literature as the sterile diet, the low-bacterial diet, and the low microbial diet. Many healthcare facilities have institutional policies regarding dietary restrictions for neutropenic patients. However, no standard definition of the neutropenic diet exists. In early studies, the neutropenic diet included a limited number of foods that could be sterilized (Bodey, Rodriguez, Murry, Burgess, & Benjamin, 1981; Buckner et al., 1978; Levine et al., 1973; Preisler, Goldstein, & Henderson, 1970; Schimpff et al., 1975; Yates & Holland, 1973).

More recently, surveys have been conducted using a number of definitions for the neutropenic diet (French, Levy-Milne, & Zibrik, 2001). A survey of 35 bone marrow transplant programs found that a variety of diets were used, most often a completely sterile diet (i.e., foods that have been rendered sterile by canning, prolonged baking, autoclaving, or irradiation), a low-bacteria diet (i.e., well-cooked foods or foods with a minimum of potential pathogen-forming units), or a modified house diet (i.e., a regular diet without fresh fruits or vegetables) (Denzenhall, Curry-Bartley, Blackburn, De Lamerens, & Khan, 1987). In a small survey of hospitals performing pediatric bone marrow transplantation, French et al. found that the majority provided patients with a low microbial diet to reduce the potential risk of infections resulting from food-borne pathogens. The definition of *low microbial diet* was interpreted widely, from total avoidance of raw dairy products, herbs, honey, fresh fruits and vegetables, deli meats and cheeses, and well water to the exclusion of fresh fruits and vegetables only or the inclusion of well-cooked foods only. The surveys concentrated on inpatient bone marrow transplant units; outpatients receiving chemotherapy or post-hospital diet restrictions were not included.

When surveying the institutional practices of 400 members of the Association of Community Cancer Centers regarding diet restrictions for patients with neutropenia, Smith and Besser (2000) found that, although 78% of responding institutions placed patients on dietary restrictions during neutropenia, the definition of *neutropenic diet* varied widely by institution. The most commonly prohibited food items were fresh vegetables (98%), fresh fruits (93%), fresh juices (93%), and raw eggs (76%). Food preparation and storage were not addressed. Seventy percent of institutions advised patients to continue the neutropenic diet, as it was defined, at home.

Current use of the neutropenic diet is based on early research in application of a total protective environment in the hospital setting for the treatment, primarily, of leukemia (Bodey et al., 1981; Buckner et al., 1978; Levine et al., 1973; Preisler et al., 1970; Schimpff et al., 1975; Yates & Holland, 1973). The rationale for putting patients in a protective environment was to prevent exposure to endogenous and exogenous sources of bacteria and, therefore, avoid infections and allow for administration of the full, intended dose of chemotherapy. The neutropenic diet was just one component of the protective environment, which also included isolation rooms, laminar airflow units, and gut sterilization by antimicrobial suppressive agents. Schwartz and Perry (1966) reported the results of the first eight patients to be treated in a total protective environment. In preparation for putting patients into a protective isolation unit, baseline cultures of all body orifices as well as stool cultures were taken. For three days prior to entry, patients showered with hexachlorophene twice daily and put on sterile pajamas afterward. The bed sheets were changed to sterile linens. Patients' gastrointestinal tracks were cleansed with castor oil and a soapsuds enema. A course of antibiotics was prescribed. During the isolation period, patients were given canned foods only, and these were prewrapped and sterilized with ethylene oxide. All other items, from newspapers to procedure instruments, were sterilized before entering the isolation unit. When chemotherapy was completed and patients' ANC returned to levels above 1,500/mm^3, they were given fresh yogurt and antibiotics were continued for two additional days. Patients then were started on a house diet and removed from the isolation unit. In this limited series, patients were able to tolerate higher doses of chemotherapy with less toxicity, including infections. The authors related the findings to the absence of bacteria or bacterial endotoxins as a result of total protective isolation protocol.

Levitan and Perry (1967) studied 11 patients undergoing intensive chemotherapy in a similar fashion in a protective isolation system. The stated purpose of the isolation system was to prevent introduction of exogenous organisms and reduce patients' own flora during exposure to chemotherapy. Patients were served canned foods that had been sterilized with ethylene oxide prior to opening and meats and vegetables that had been steam-sterilized. The study found that all organisms that caused infections during chemotherapy had been cultured during routine surveillance from various body sites prior to the infectious episode.

The use of antibiotics in the total protective environment has been studied extensively. In all cases, a sterile diet or foods known to have low bacterial counts were included (Bodey, Hart, Freireich, & Frei, 1968; Schimpff et al., 1975; Yates & Holland, 1973). The studies showed that patients in protective isolation who were put on nonabsorbable antibiotics had fewer infections than anticipated. The contribution of the neutropenic diet to the results was not considered.

Lynch, Jameson, Gamble, and Kay (1971) reviewed studies involving leukopenic patients in protective isolation during a period of five years. Although the neutropenic diet was not identified as an independent variable in the studies reviewed, Lynch et al. included the risk of gram-negative septicemia from food-borne organisms as important. They suggested prophylaxis with nonabsorbable antibiotics as an alternative to sterile food but expressed concern about its economic impact.

No study has compared the effectiveness of sterile and low microbial diets in preventing infection through the mouth, oropharynx, or esophagus (Aker & Cheney, 1983). The use of the neutropenic diet in a total protective environment has been translated to all settings based on logic, prudent practice, and reasonable theoretical rationale (Fenelon, 1995; Remington & Schimpff, 1981; Somerville, 1986). Moody, Charlson, and Finlay (2002) pointed out that various components of a total protective environment have been abandoned in medical practice because they are labor intensive and expensive and may raise quality-of-life issues for patients. The only exception has been the neutropenic diet, despite the fact that the concept has the least amount of evidence supporting its usefulness. Little attention has been paid as more patients are being treated with chemotherapy in outpatient settings. With the advent of colony-stimulating factors, fewer neutropenic patients are being admitted to the hospital. No studies have evaluated the use of the neutropenic diet alone in the outpatient setting.

Quality-of-life issues related to the neutropenic diet also must be considered. Patients receiving chemotherapy must cope with many stressful issues related to physical symptoms, body image changes, an unsure future, and navigating the healthcare system. Often, patients and families emphasize appetite and weight as variables that are within their control. Food frequently is seen as a nurturing entity. The side effects of chemotherapy and the disease itself can make nutritional intake difficult. Adherence to the restrictions of the neutropenic diet has been identified in the literature as an area of concern (Pizzo, 1984; Pizzo, Purvis, & Waters, 1982; Todd, Schmidt, Christain, & Williams, 1999). Pizzo (1981, 1984) found the neutropenic diet, as a part of a total protective environment, to be cumbersome and expensive. Additional restrictions in terms of a special neutropenic diet may be overwhelming to patients and families.

Purpose

This descriptive pilot study sought to determine the effects of the neutropenic diet in the outpatient setting. The study aims were to determine whether patients were able to comply with the neutropenic diet, whether the number of febrile admissions between compliant and noncompliant patients would differ, and the difference, if any, in the number of positive blood cultures for gram-negative rods between compliant and noncompliant patients. For the purpose of the study, neutropenia was defined as an ANC lower than 1,000/mm^3.

Methods

Sample and Setting

The study was conducted in an outpatient chemotherapy setting. A convenience sample was recruited on or before patients' first day of chemotherapy at a cancer center in a large metropolitan area. To meet the inclusion criteria, participants had to be 18–70 years old and receiving chemotherapy regimens associated with a high incidence of neutropenia that do not require pretreatment with colony-stimulating factors or those used for cancers that usually are not associated with alterations in blood counts prior to treatment. Exclusion criteria included patients with a diagnosis of acute leukemia or HIV or those receiving enteral or parenteral nutrition, consuming

Safe Shopping
- Check expiration dates.
- Do not buy meat, fish, or poultry products in damaged packages.

Safe Storing
- Hang thermometer provided in a visible location in your refrigerator.
- Keep refrigerator temperature at 34ºF–40ºF.
- Use leftovers within three to four days.
- Keep packages of fresh meat, fish, and poultry in a separate bag and store on the bottom shelf in the refrigerator.

In the Freezer
- Keep the freezer temperature lower than 0ºF.

Safe Preparation
- Wash hands thoroughly with warm, soapy water for 20 seconds prior to handling foods.
- Wash hands before and after eating.
- Clean work surfaces often. Make, daily, a mixture of 1 tablespoon bleach to 1 quart water.
- Rinse all fresh fruits and vegetables with clean running water prior to use.
- Thaw meat, poultry, and fish in the refrigerator.
- Use separate cutting boards, plates, trays, and utensils for cooked and uncooked foods.

Safe Cooking and Serving
- Use the meat thermometer provided to check that meat, poultry, and fish reach the proper temperature.

Do Not Eat the Following Foods
- Raw fruits, including raisins and other dried fruits: Eat fresh fruits cooked only (e.g., raisin bread, apple pie, stewed prunes), or purchase canned or frozen fruits.
- Raw vegetables: Avoid all salads and other uncooked vegetables. This includes raw vegetables in pasta, egg salad, tuna salad, and raw or dried herbs added to hot dishes after cooking.
- Do not drink any juices (fruit or vegetable) that have not been pasteurized.
- Do not eat food from salad bars and restaurants that are served buffet style (e.g., all-you-can-eat restaurants).
- Do not eat food from sidewalk food cart vendors. Fast food restaurants with appropriate heating mechanisms to keep hot food hot, refrigerators for cold food, and hand-washing facilities for employees are acceptable.
- Do not eat raw, rare, or medium-cooked meats and fish. This includes clams on the half shell, rare hamburgers, eggs, or food containing these items.

Figure 1. The Neutropenic Diet

Note. Portions of this figure are from "Safe Eating: A Guide to Preventing Food-Borne Illness," by the American Dietetic Association, 1997, Chicago: Author. Copyright 1997 by the American Dietetic Association. Adapted with permission.

an all-liquid diet, or undergoing stem cell transplantation. Patients with acute leukemia or HIV and those undergoing stem cell transplantations were excluded because they often have abnormal blood counts regardless of treatment and require colony-stimulating factors.

Instruments

Questionnaires were developed to document demographic and medical variables as well as baseline knowledge of food safety and the neutropenic diet. Adherence to restrictions of the neutropenic diet was measured via self-report based on "yes" or "no" questions and a food-use questionnaire. The 6- and 12-week evaluations measured dietary adherence as a self-reported subjective statement with "yes" or "no" responses. Adherence was verified via eight questions targeting specific points of the food safety aspects and diet restrictions covered in the instruction. Patients' degree of difficulty in following the diet was assessed using Likert scales with four response choices. Patients were questioned regarding hospital admissions; however, the researchers verified all admission information via chart review. The instrument designed to collect information was developed specifically for this study to assess the major aspects of the neutropenic diet for food safety and the diet instructions as given to patients. Content validity was established by review of the tool by a multidisciplinary team.

A chart review was conducted post-treatment to validate self-reported medical information and verify neutropenia (i.e., ANC < 1,000/mm^3). The chart review also was developed specifically for this study and was reviewed by a multidisciplinary team for content validity.

Procedures

The institutional medical center review committee approved the study. Participants were recruited on or before their first day of chemotherapy. Patients' medical information was reviewed to verify that they met the inclusion criteria before they were asked to join the study. Only patients who fulfilled eligibility requirements were approached regarding participation. The initial intent was to enroll 60 patients during a one-year period. However, the study enrollment period was extended by seven months, with a total of only 28 patients agreeing to participate in 19 months. At the first meeting, the objectives of the study were explained to patients and consent was obtained and documented. Patients were interviewed for demographic information and baseline knowledge of food safety and the neutropenic diet (see Figure 1). Education regarding the neutropenic diet was provided and included food safety and elements of the traditional neutropenic diet. The food safety aspects were based on a brochure published by the American Dietetic Association ([ADA], 1997) titled *Safe Eating: A Guide to Preventing Food-Borne Illness*. Approval was received from the ADA for use of the information. Neutropenic diet restrictions, though inconsistently defined in the literature, were described in a survey of 120 institutions (Smith & Besser, 2000). For the purpose of the study, the definition of the neutropenic diet was based on the food and beverage restrictions chosen by 48% or more of the institutions.

Patients were given a packet that included the neutropenic diet, the *Safe Eating: A Guide to Preventing Food-Borne Illness* brochure (ADA, 1997), a copy of their signed informed consent, and refrigerator and meat thermometers. Use of the thermometers was reviewed. All patients were informed that they had the right to withdraw from the study at any time. Trained, hired support staff conducted telephone interviews at weeks 6 and 12. Questions were asked regarding perceived dietary adherence, actual dietary adherence based on frequency of food consumed, and information regarding febrile admissions and blood cultures. A retrospective review of hospital admission data and patients' medical records was conducted to verify self-reported data regarding febrile admissions and positive blood cultures for gram-negative rods.

Data Analysis

Demographic data and diet adherence were summarized using descriptive statistics. Fisher's Exact Test with a 0.05 significance level was used to compare various proportions between the two adherence groups. Specifically, the test compared the proportion of compliant patients who had at least one febrile admission to those who were noncompliant. The compliance score was based on eight questions related to food safety and diet restriction. Each question regarding frequency of consumption was given a score of 1 (lowest score) to 4 (highest score). An average score was calculated from the eight answers. The compliance score was calculated at 6 and 12 weeks, added together, and divided by two. A

Table 1. Summary Demographic Data

Characteristic	n
Age (years)	
18–30	1
31–50	14
51–70	13
Type of cancer	
Breast	13
Lung	2
Ovarian	3
Sarcoma	5
Pancreatic	2
Multiple myeloma	1
Non-Hodgkin lymphoma	1
Hepatic	1
Race	
Black	6
White, not Hispanic	21
Hispanic	1
Primary person responsible for meal preparation	
Self	22
Spouse	6
Other	–
Education level	
Elementary education (through eighth grade)	7
High school graduate	1
Partial college	11
College graduate	6
Graduate degree	3
Employment status	
Full-time	17
Part-time	5
Student	1
Not currently working	5

N = 28

score of 3.5 or higher was deemed compliant. In addition, the proportion of patients who had a positive blood culture was compared for the two groups. SAS statistical software version 8.02 (SAS Institute Inc., Cary, NC) was used for data management and statistical analyses. The sample sizes for this pilot study were very small; therefore, the power to detect statistically significant differences was low. However, the results are reported as trends for guiding future design decisions for a broader, randomized clinical trial.

Findings

Twenty-eight patients were enrolled in the study, but only 23 completed the 12-week program. The average age was 50 years, with a range of 33–67 years. Five (22%) of the 23 who completed the study listed their race as black, and 18 (78%) of 23 listed their race as "white, not Hispanic." Table 1 shows demographic data for all 28 participants. Table 2 summarizes patients' baseline knowledge prior to instruction. Table 3 details the findings of the three study aims. Sixteen (70%) of the 23 patients were compliant with the neutropenic diet according to adherence scores. The average age of compliant patients was 50 years (range = 33–67). Four (25%) of the 16 patients in the compliance group were African American. The average age of the seven noncompliant patients also was 50 years (range = 41–55). Of the seven noncompliant patients (as determined by calculated compliance scores), only four perceived that they were noncompliant.

The second aim of the study was to determine whether the rate of febrile admissions between compliant and noncompliant patients would differ. Of the 23 patients who completed the study, nine were admitted to a hospital or visited an emergency room; however, only five admissions were for neutropenia (22%). Of the 16 compliant patients, four (25%) were admitted for neutropenia. Of the seven noncompliant patients, one was admitted for neutropenia. The difference between groups was not statistically significant.

The third aim of the study was to determine whether a difference existed in the rate of blood cultures positive for gram-negative rods between compliant and noncompliant patients. Of the five patients with neutropenic admissions, four had gram-negative rods and one had gram-positive rods. Three (75%) of the four compliant patients who were admitted for neutropenia had gram-negative rods. The one noncompliant patient admitted for neutropenia also had gram-negative rods. The difference between groups in this case also was not statistically significant.

Discussion

Thirty percent of participants were noncompliant with the neutropenic diet; however, no significant differences were found in the rates of febrile admissions or positive blood cultures between compliant and noncompliant patients. The clinical significance in this pilot study is related to the time required for diet education, content of diet education regarding food restrictions, and difficulty adhering to diet requirements given the multitude of side effects of chemotherapy. Future study is required to determine the best practice to improve outcomes for the treatment of neutropenia.

The study had several limitations. The inclusion criteria for chemotherapy regimens and diagnoses were broad, and the time frame for enrollment was too narrow. The small sample size made generalization of findings difficult. The difficulty with accrual was multifactorial: Patients overwhelmed by starting chemotherapy, other individuals in the household with responsibility for food preparation, and seasonal variation in food availability seemed to affect enrollment (e.g., more patients declined as spring and summer produce started to arrive in supermarkets). Another limitation was that the accuracy of patients' self-reporting compliance over a 6- and 12-week period of time was low; consequently, the period scores were averaged. Finally, some research staff were nondedicated because funds were

Table 2. Initial Evaluation of Baseline Knowledge

Question	Yes	No	No Response
Have you ever followed a neutropenic diet?	2	26	–
Do you normally eat raw fruits and vegetables?	24	4	–
Do you eat dried fruit?	18	10	–
Do you eat prepared salads (e.g., potato, pasta, egg, or chicken salads with raw celery, onions, or raisins)?	22	5	1
Do you drink unpasteurized juices (e.g., self-juicing, farm-stand cider, nonjuice drinks from juice bars)?	6	22	–
Do you eat at salad bars, buffets, or sidewalk vendors?	16	12	–
Do you eat oysters, clams, raw sushi, or other undercooked meats (e.g., rare hamburgers or steaks)?	6	22	–
Do you normally wash your hands prior to handling food?	24	3	1
Do you have a thermometer in your refrigerator at home?	6	22	–
Have you ever checked the temperature in your refrigerator?	6	22	–

Question	Never	Weekly or More Often	Daily or More Often	No Response
How often do you use the following methods to thaw frozen meats when you take them out of the freezer?				
• On the countertop	9	16	2	1
• In the refrigerator	7	18	2	1
• In the sink in water	24	4	–	–
• In the microwave	14	12	1	1

N = 28

Table 3. Study Findings

Compliance With Diet	n	Febrile Admissions	Presence of Gram-Negative Rods
Compliant	16	4	3
Noncompliant	7	1	1

N = 23

not available. Study staff experienced conflicts with other patient care priorities.

The study should be repeated with a larger number of subjects. Accrual would be higher if staff were dedicated to conducting the research. The inclusion of a research assistant is recommended. In addition, the study enrollment period could be broadened. The study was designed to begin on or before the first day of chemotherapy, which was a limitation to enrollment because many patients declined participation, stating that they were too overwhelmed. The use of multiple sites for a future study also would facilitate patient accrual. Because no universally established guidelines for the neutropenic diet have been published, a need exists to investigate what the specifics of the diet should be, if it is to be used at all. Broadening the potential sources of gram-negative rods to include contaminated water supplies may be useful. Comparing different types of neutropenic diets (e.g., restrictive versus less restrictive, neutropenic diet versus food safety education only) or using a control group also may be beneficial. The duration of neutropenia should be determined regardless of febrile admissions, and data regarding the length of the neutropenic event, severity of neutropenia, and frequency with which patients are hospitalized or report to the emergency room for neutropenic fever also should be collected. In addition, monitoring side effects along with the impact of the neutropenic diet on overall quality of life should be a research variable. Data collection could be expanded to include the use of prophylactic antibiotics and colony-stimulating factors. Prospectively following patients over a longer period of time also would strengthen the results. Many factors contribute to the development of neutropenic infections (e.g., central line catheters, community-acquired infections, the presence of medications that may disrupt normal gut flora). Those variables were not examined in this pilot study but should be included in a larger study.

Implications for Nursing

The efficacy of a neutropenic diet for patients with cancer being treated with chemotherapy in the outpatient setting has not been established. In addition, neutropenic diets are not standardized across settings. Opportunistic infections remain a significant cause of morbidity and mortality for patients with cancer undergoing chemotherapy, and research has examined interventions to decrease the incidence of infection by decreasing patients' exposure to bacteria during neutropenia. However, the independent effect of diet has not been examined. Oncology nurses are on the front line, educating patients regarding the identification and management of side effects of treatment and providing symptom management as symptoms occur.

Nursing assessment and teaching activities with patients undergoing chemotherapy should include a comprehensive nutritional assessment and evaluation of risk factors for neutropenia and bacterial infections. Among the risk factors could be food and water sources. Nursing research is needed to establish criteria recommending a restrictive neutropenic diet versus a less restrictive food safety education program with patients undergoing chemotherapy in the outpatient setting to determine the best evidence-based care for patients. This pilot study provides the first step toward research to enhance patients' overall outcomes and improve quality of life.

Author Contact: Debra DeMille, MS, RD, LDN, can be reached at dedemi@pahosp.com, with copy to editor at ONFEditor@ons.org.

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