

# Safety of Water Consumption Among Hematopoietic Stem Cell Transplant Recipients

Linda K. Leising, RD, CDN Melissa McKernon Lauren M. Dunford Theresa Hahn, PhD Philip L. McCarthy, Jr, MD

## Abstract

Hematopoietic stem cell transplant (HSCT) recipients are at high risk of infection due to neutropenia. They usually are advised to modify their diets to lessen their risk of infection from ingestion of bacterial and viral pathogens. Drinking water is a possible source of infection. This article discusses the types of drinking water that patients may consume, the methods that may be used to treat these types of water, and the overall level of safety such efforts may offer to the HSCT recipient.

## Introduction

Patients undergoing chemotherapy, radiation therapy, and HSCT are at high risk for neutropenia. In addition, allogeneic HSCT patients often receive prolonged immunosuppression, placing them at risk for opportunistic infections. Therefore, such patients generally are advised to modify their diets to lower their risk of exposure to foodborne infections from bacteria, yeasts, molds, and parasites (1). The specific recommended diet modifications vary by prescribing facility because interpretation of the scientific evidence available to guide the medical staff is somewhat limited. Clinicians not only must consider the likelihood of infection for the patient consuming the item, but also the effect of the diet limitation on the patient's quality of life. This is especially pertinent for patients who may be at chronic risk due to medical complications after transplant, which makes the diet modifications a permanent part of their daily lives.

Although there is debate about what types of food/beverages should be limited, the safety of the water source that immunocompromised patients choose to consume must be considered. Waterborne pathogens can cause medical complications in immunocompromised patients, including gastroenteritis, chronic diarrhea, and

pneumonia (2). Examples of waterborne pathogens include *Escherichia coli*, *Legionella* sp, *Giardia lamblia*, and *Cryptosporidium* sp, the latter being a parasite commonly found in water sources that come into contact with sewage and animal waste (2). These contaminants can cause gastrointestinal illness in otherwise healthy people, but can cause severe symptoms in immunocompromised individuals and can be a contributing cause of death (2).

Medical staff treating immunocompromised HSCT patients should consider the three primary types of water their patients may consume and examine the evidence regarding pathogens in these sources to guide choices.

## Well Water

According to the Centers for Disease Control and Prevention (CDC), private wells or public wells serving limited populations may be tested too infrequently to ensure that the water is free of harmful bacterial contamination (1). Generally, municipal wells serving highly populated areas may be considered safe because they are tested more than twice daily for bacterial contamination. Consumers of municipal well water should be vigilant to watch for media "boil-water" advisories, and in those cases, heat their water for at least 1 minute at a rolling boil prior to consuming it for drinking or using it for oral hygiene (1). Owners of private wells generally do not have their well water tested daily for contamination. Therefore, immunocompromised consumers of private well water should heat this water for at least 1 minute at a rolling boil prior to drinking it or using it for oral hygiene.

## Tap Water

The United States Environmental Protection Agency (EPA) sets the standards for the quality of drinking water based on the Safe Water Drinking Act and oversees water suppliers

implementing these standards (3). Municipal water authorities perform rigorous testing to assure the safety of tap water by meeting the EPA standards for approximately 145 regulated contaminants in drinking water. The legal limit for each of these contaminants is called the maximum contaminant level. EPA regulations specify stringent testing and reporting requirements for each contaminant. Municipal water treatment centers are mandated by the EPA to notify customers if their water is not safe to drink via a mass media "boil-water order."

Chlorination is one method used to treat municipal water. It is a residual process, which means that traces of chlorine remain in the water after application, enhancing water quality as it travels to the consumer. Chlorine is a traditional treatment for microbes such as *Giardia*, although it does not clear the accumulation of microbes on the inner sides of pipes through which the water must travel to reach the consumer.

Some patients may wish to filter their water in their homes as an additional precaution, although this is not an official CDC recommendation for immunocompromised patients using municipal tap water. For home filtration systems to be effective in eliminating bacteria such as *Cryptosporidium*, the filter must be capable of eliminating particles of at least 1 micron in diameter, use reverse osmosis, or be labeled certified by National Sanitation Foundation International (2). Because such filters are not always capable of removing smaller microbes, they are most effective in enhancing the quality of water that already has been treated municipally. It is important to remember that the filter is only effective if it is used and regularly changed according to manufacturer directions (2).

Restaurants normally serve patrons drinking water or ice from machines. Consumption of such water or ice is

(Continued on page 16)

Improved Clinical Outcomes in Patients with

# Sepsis,<sup>1</sup> ARDS,<sup>2-5</sup> ALI<sup>6</sup>

Oxepa<sup>®</sup> — unique, specialized enteral nutrition therapy with

- EPA (eicosapentaenoic acid)
- GLA (gamma-linolenic acid)
- Elevated Antioxidants

Oxepa<sup>®</sup> is clinically shown to modulate the inflammatory response in critically ill, mechanically ventilated patients.

Oxepa<sup>®</sup> works. Clinical trials show

- More ventilator-free days
- More ICU-free days
- Reduced new organ failures
- Lower mortality rates

## Oxepa<sup>®</sup> works. 7 clinical trials. 5 patient populations studied.

Population Studied	Improved Oxygenation	Reduced ICU LOS	Reduced Time on Vent	Reduced New Organ Failures	Reduced Mortality	Safety
ARDS	X <sup>2,3,5</sup>	X <sup>2,3</sup>	X <sup>3</sup>	X <sup>2,3</sup>		X <sup>2,3,5</sup>
ALI	X <sup>6</sup>	X <sup>6</sup>	X <sup>6</sup>			X <sup>6</sup>
Sepsis	X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>
Pediatric Burn	X <sup>4</sup>					X <sup>4</sup>
Pediatric ICU						X <sup>7</sup>

## Choose Oxepa<sup>®</sup>!

For more information visit [www.Oxepa.com](http://www.Oxepa.com)

To review the latest published study, please refer to “Benefit of enteral diet enriched with eicosapentaenoic acid and gamma-linolenic acid in ventilated patients with acute lung injury” in the April 2006, Vol. 34, issue of Critical Care Medicine.

To receive reprints of other published clinical studies or to request samples for a trial in your facility **call 800-227-5767** (within US only). For locations outside of the 50 United States, please contact your local Abbott Laboratories office for more information.

**References:** 1. Arago AM, Albuquerque JD, Pontes-Arruda A, et al: Enteral feeding with eicosapentaenoic acid and γ-linolenic acid as a new strategy to reduce mortality and improve outcomes in patients with severe sepsis and septic shock. *Crit Care Med* 2005; Vol. 33, No. 12 (Suppl). 2. Elamin ME, Hughes LF, et al: Effect of enteral nutrition with eicosapentaenoic acid (EPA), Gamma-Linolenic Acid (GLA), and Antioxidants Reduces Alveolar Inflammatory Mediators and Protein Influx in Patients with Acute Respiratory Distress Syndrome (ARDS). *Chest* 2005;128:225s. 3. Gadek JE, DeMichele SJ, Karlstad MD, et al (Enteral Nutrition in ARDS Study Group): Effect of enteral feeding with eicosapentaenoic acid, gamma-linolenic acid, and antioxidants in patients with acute respiratory distress syndrome. *Crit Care Med* 1999;27(8):1409-1420. 4. Mayes T, Gottschlich M, Carman B, et al: An evaluation of the safety and efficacy of an anti-inflammatory, pulmonary enteral formula in the treatment of pediatric burn patients with respiratory failure. *Nutr Clin Prac* 2005;20:30-31. 5. Pacht ER, DeMichele SJ, Nelson JL, et al: Enteral nutrition with eicosapentaenoic acid, gamma-linolenic acid, and antioxidants reduces alveolar inflammatory mediators and protein influx in patients with acute respiratory distress syndrome. *Crit Care Med* 2003;31(2):491-500. 6. Singer P, Theilla M, Fisher H, et al: Benefit of an enteral diet enriched with eicosapentaenoic acid and gamma-linolenic acid in ventilated patients with acute lung injury. *Crit Care Med* 2006;34(4), in press. 7. Nadkarni V, et al. *Crit Care Med* 2005; 33(Suppl 12):A125. 8. Gadek J, DeMichele S, Nelson J, et al: Specialized enteral nutrition, Oxepa, suppresses intrapulmonary inflammatory mediators in patients with acute respiratory distress syndrome (ARDS). *Crit Care Med* 1999;27(12):A125. 9. Teres D, Rapoport J, et al: Length of stay as a guide to hospital economic performance for ICU patients. *Crit Care* 2001; 5 (suppl 1):P258. 10. Project Impact CCM, Inc. [www.projectimpactccm.com](http://www.projectimpactccm.com) 11. Salipente DM: Developing a multidisciplinary weaning unit through collaboration. *Crit Care Nurse* 2002;22(4):30. 12. In the Gadek study (see 3 above), patients on average received 1700 Cal/day or 50 cc/hr. Assuming a cost of Oxepa of \$120.00 per case and 4 to 5 cans/day, the cost of Oxepa is \$20 to \$25 per day.



# How Oxepa<sup>®</sup> Works

**Clinical Catastrophe**

**Inflammatory Response Initiated**  
Arachidonic acid metabolites & oxygen free radicals produced

**GLA**  
(borage oil)  
elongates to  
**DGLA**

**Arachidonic Acid (AA)**  
(a proinflammatory fatty acid)

**EPA**  
(sardine oil)

**Anti-oxidants**  
(all-natural vitamin E,  
vitamin C, β-carotene,  
taurine)

DGLA & EPA  
Compete with AA for  
**Cyclooxygenase**

Replacing AA with  
DGLA results in  
**Increased PGE<sub>1</sub> & eicosanoids that are less inflammatory**

Resulting in  
**Fewer proinflammatory eicosanoids**  
(LTB<sub>4</sub>, TXA<sub>2</sub>, PGE<sub>2</sub>)

Replacing AA with  
EPA results in  
**More eicosanoids that are less inflammatory**  
(TXA<sub>3</sub>, PGI<sub>3</sub>, LTB<sub>5</sub>)

Decreased free radical damage

PGE<sub>1</sub> is a pulmonary vasodilator that improves circulation, gas exchange and oxygenation.

Decreased Pulmonary Inflammation and Edema and Facilitates Pulmonary Vasodilation (PGE<sub>1</sub>)<sup>3,5,8</sup> Which Leads to Improved Oxygenation<sup>1-6</sup>

Decreased Vent Time<sup>1,3,6</sup>  
Reduced New Organ Failures<sup>1-3</sup>

Decreased Length of Stay in ICU<sup>1-3,6</sup>  
Lower Mortality Rates<sup>1</sup>

In light of the clinical evidence, can you afford not to use Oxepa<sup>®</sup>?

## Cost of Care

Average Cost per Day	
ARDS Patient	\$8500 <sup>9</sup>
ICU Bed	\$2500 <sup>10</sup>
Ventilator Support	\$1000 <sup>11</sup>
Oxepa <sup>®</sup>	\$25 <sup>12</sup>

**Oxepa<sup>®</sup>**  
Scientifically formulated...  
Clinically proven...  
Cost effective.

Use under medical supervision.

© 2006 Abbott Laboratories  
69169/MARCH 2006 LITHO IN USA

**ROSS PRODUCTS DIVISION**  
**ABBOTT LABORATORIES INC.**  
COLUMBUS, OHIO 43215-1724

**ROSS**  
NUTRITION

**Table.** Examples of Bottled Water

Brand	Manufacturer	Source	≤1 micron Filtration	Reverse Osmosis	Distillation	UV Light	O <sub>3</sub>
Aquafina®	Pepsi®	Municipal	×	×		×	×
Dasani®	Coca-Cola®	Municipal		×			
Deer Park Brand Drinking Water®	Nestlé Waters®	Municipal	×	×	×	×	×
Deer Park Natural Spring Water®	Nestlé Waters®	Spring	×			×	×
Evian®	Groupe Danone®	Spring					
Great Bear Natural Spring Water®	Nestlé Waters®	Spring	×			×	×
Ice Mountain Natural Spring Water®	Nestlé Waters®	Spring	×			×	×
Ice Mountain Brand Drinking Water®	Nestlé Waters®	Municipal	×	×	×	×	×
Ice Mountain Drinking Fluoridated Water®	Nestlé Waters®	Municipal	×	×	×	×	×
Poland Spring Natural Spring Water®	Nestlé Waters®	Spring	×			×	×

Note: The use of the brand names/trademarks is not authorized by, associated with, or sponsored by the trademark owner.

not recommended for immunocompromised patients because it is difficult to determine if the type of filtration on the machine used to dispense the water or ice is of a grade that is acceptable for filtration of microbes. It is also unknown by the consumer how often the filter is changed, if at all. Water from public drinking fountains should also be avoided due to the questionable cleanliness of the drinking spout from chronic public use as well as the grade of the internal filtration system.

## Bottled Water

### Distillation

Distilled water is boiled, forming a vapor, which travels through a condensing coil and returns to liquid form. Because bacteria and most other contaminants cannot undergo this phase change, they are left behind, producing a nearly uncontaminated condensate or distillate (4). Some bottled water manufacturers offer “distilled drinking water,” which means that minerals are added to the water following the distillation treatment to enhance the taste of the water for drinking purposes. Distillation, when carried out properly, has the potential to remove impurities in water to the point

of 10 parts per trillion (5), thus making it the most reliable type of treated water for HSCT patients to consume.

### Reverse Osmosis

Reverse osmosis is a molecular-level filtration process in which water is pressured against a semipermeable membrane. As the water is filtered through the membrane, most minerals and impurities are trapped in it (4). The water that does not filter through the membrane carries away the blocked impurities. This process must be closely monitored because “membrane fouling” or degradation in the quality of the membrane can occur, which can allow contaminants to pass into the treated water (6). Overall, this process is sufficiently effective to render this method of treatment for bottled water safe for HSCT recipients, according to the CDC (1).

### Absolute 1-micron Filtration

In this process, untreated water passes through a filter that is capable of removing particles larger than one micrometer in size, such as *Cryptosporidium* and *Giardia*. This type of filtration is only as effective as the micrometer size of the filter; the smaller the filtration (e.g., 0.2 microns),

the less likely harmful pathogens will remain in the filtered water product.

### Ozonation and Ultraviolet (UV) Light Radiation

Ozonation is the process of running ozone gas (O<sub>3</sub>) through the water, serving as a disinfectant. The ozone can inactivate bacteria, such as *Cryptosporidium* and *Giardia*, and quickly dissipates to form oxygen (O<sub>2</sub>) (4). However, ozonation offers no residual effect because the ozone has a short half-life, so it must be added to the water continuously to prevent bacterial reactivation.

UV light reduces bacteria in water by destroying their DNA and leaves no traces of UV light radiation in the water end product. However, it is only effective upon direct contact with microbes. Inadequate amounts of UV light may only damage the bacteria, leaving the potential for reactivation (4).

Both ozonation and UV light treatment are most effective when coupled with other, more reliable methods of water purification. Neither of these methods of treating water, on an independent basis, is considered effective in yielding a product safe for an immunocompromised individual to consume.

## Conclusions

Patients undergoing HSCT should be encouraged to investigate the methods used by their local water supplier to make an educated decision regarding the safety of their drinking water. They should inquire as to the type of treatment(s) used as well as the frequency of testing for pathogens.

If bottled water is preferable for everyday use, or as an alternative when traveling away from home, the patient should consider the type of treatment(s), if any, used by their manufacturer of choice (Table). Some bottled water manufacturers state that their water is completely natural and has never undergone treatment, which may be an effective marketing tool, but does not guarantee uncontaminated water for an HSCT recipient.

When we have researched popular brands of bottled water sold to patients in our area, major manufacturing companies have been willing to share with consumers the specific methods they use to treat their bottled water. Answers to consumer questions can be obtained by calling the consumer phone number listed on the label or contacting the manufacturers via e-mail on the Web sites listed.

Some bottled water brands state on the label the primary type of treatment

used, such as reverse osmosis or distillation. It would be ideal for bottled water manufacturers to be mandated to state prominently on the label the treatment method(s) used in the manufacturing process. Until that day arrives, dietitians can research local municipal water treatment methods as well as the treatment(s) used for popular brands of bottled water sold locally. Dietitians can share the information with patients when educating them on diet guidelines, helping them to make informed choices and prevent potential infections.

*Linda K. Leising, RD, CDN, is the clinical dietitian for the Division of Blood and Marrow Transplantation at Roswell Park Cancer Institute, Buffalo, NY.*

*Melissa McKernon is a premed student at Boston College, Boston, Mass.*

*Lauren M. Dunford is a medical student at the University of Buffalo School of Medicine and Biomedical Sciences, Buffalo, NY.*

*Theresa Hahn, PhD, is the epidemiologist for the Division of Blood and Marrow Transplantation at Roswell Park Cancer Institute, Buffalo, NY.*

*Philip L. McCarthy Jr, MD, is Chief of the Division of Blood and Marrow Transplantation at Roswell Park Cancer Institute, Buffalo, NY.*

## References

- Centers for Disease Control and Prevention, Infectious Disease Society of America, American Society of Blood and Marrow Transplantation. Guidelines for preventing opportunistic infections among hematopoietic stem cell transplant recipients. *MMWR Recomm Rep*. 2000; 49(RR10): 1–128. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr4910a1.htm>.
- Environmental Protection Agency co-released with the Centers for Disease Control and Prevention. *Safe Drinking Water – Guidance for People with Severely Weakened Immune Systems*. June 1999. Available at: <http://www.epa.gov/ogwdw/crypto.html>.
- Environmental Protection Agency. *Safe Drinking Water Act (SWDA): Regulations and Guidance*. Available at: <http://www.epa.gov/safewater/regs.html#current>.
- Osmonics Corp. *The Pure Water Handbook*. 2nd ed. Minnetonka, Minn: 2001. Available at: <http://www.gewater.com/pdf/1154273-%20Lit-%20Pure%20Water%20Handbook.pdf>.
- Nestlé Water Consumer Affairs. Letter and attachment to Linda Leising, RD, from Donna K. at Poland Spring Water Company, a Division of Nestlé Waters North America, Inc. October 8, 2004.
- Eisenberg, TN, Middlebrooks, EJ. *Reverse Osmosis Treatment of Drinking Water*. New York, NY: Butterworth Publishers; 1985.

## Calling All Transplant Dietitians!

*Sara DiCecco, MS, RD*

Dietitians who work in both solid organ and stem cell transplantation are represented to the American Dietetic Association and supported via the Dietitians in Nutrition Support (DNS). DNS recognizes this important subspecialty in this issue of *Support Line* as well as the implementation of the Transplant Web Page on the DNS Web site. The primary goal of the page is to serve those who work in transplantation every day as well as those who provide nutrition services to transplant patients at a local level or who have an academic interest in this patient population.

The transplant Web page at the DNS Web site ([dnsdpg.org](http://dnsdpg.org)) contains opportunities and information. Our goal is to keep this a dynamic site, filled with continuing education, communication via the DNS listserv, and transplant-related conference calendar information. Through the Web site, e-blasts, and surveys, we regularly ask for input regarding practice issues and ways that the

DNS Transplant Network can support individual practices. If you are not already a member of the DNS listserv, I recommend that you join and that you also bookmark [dnsdpg.org](http://dnsdpg.org) and check it regularly for updates.

In addition to Web-based activities, the Transplant Network, a group of DNS members interested in transplantation, is being organized to provide resources and opportunities in other venues and a forum for practice and research activities. A transplant nutrition conference or postgraduate course, coordinated research efforts, and/or anthology updates are some of the activities being considered for this group. Please think about joining the DNS Transplant Network to offer your ideas and your time and talent to advance the practice of nutrition in transplantation. Contact Sara DiCecco through the DNS Transplant Web page or at [dicecco.sara@mayo.edu](mailto:dicecco.sara@mayo.edu).

# Medicare Enteral and Parenteral Reimbursement: Requirements for Successful Coverage and Payment

Frank R. Wojtylak, RD/CDN

## Abstract

Clinical coordination, monitoring, documentation, and consistency are the key issues related to obtaining favorable Medicare coverage. The Centers for Medicare and Medicaid Services outline specific requirements related to medical conditions for which enteral and parenteral nutrition may be the therapy of choice.

Medicare outlines specific criteria with guidelines that must be addressed for proper payment. This article provides a brief overview of the requirements for successful reimbursement along with the documentation required.

## Introduction

Medicare is a federal program enacted by Congress as part of Title 18 of the Social Security Act of 1965. It is the largest insurance program in the United States.

Medicare is one of the most challenging payors for home infusion therapy. Medicare coverage is divided into Parts A, B, C, and D, each of which provides different covered benefits (Table 1). Enrolling in Part B Medicare is strictly the choice of the recipient/beneficiary. Medicare Part B covers home infusion therapy under prosthetic devices because parenteral nutrition and enteral tube feeding replace the normal oral route of receiving nutrition.

## Medicare Eligibility/Coverage

Medicare is available to select recipients. To qualify for Medicare coverage, an individual must be:

- 65+ years of age
- Entitled to Social Security benefits and/or Railroad Retirement
- Younger than age 65 years, but disabled for >2 years
- Younger than age 65 years, with end-stage renal disease

For purposes of management, Medicare beneficiaries are assigned to one of four Durable Medical Equipment

Regional Carrier (DME MAC) regions (based on their permanent address). The DME MACs will be the governing and coordinating entities that administer federally mandated Medicare policy (Table 2).

## Qualification for Home Nutrition Therapy

To qualify patients for Nutritional Coverage (Parenteral and Enteral Nutrition)/Therapy (Part B – Medicare), the following must be ascertained:

- Has the patient/beneficiary been “qualified” for services under Part B Medicare? Has this information been confirmed?
- When does the patient turn age 65?
- What is the state of primary residence of the recipient? (This determines in what jurisdiction the patient will be processed.)

- Is the patient or spouse the primary holder of the insurance? Are there other supplemental insurances that may affect overall coverage?
- What is the duration of the services provided? Are specific criteria obtained for provision of services under Medicare policy?
- Are the patient, health-care practitioner, and health-care providers in agreement with sound, long-term plans of care?
- Is the patient fully informed of services provided and costs associated with the therapy he or she is receiving?
- Is there anatomic impairment to the gastrointestinal tract and a need for “permanent” or ongoing long-term therapy?

**Table 1. Medicare Covered Benefits**

### Medicare Part A

- Inpatient health coverage
- Intermittent skilled care
- Rehabilitation treatment
- Short-term skilled nursing therapy
- Hospice care
- Some medical equipment/supplies
- Blood/blood products

### Medicare Part B

- Outpatient hospital services
- Physician services and advanced practice nurse services
- Emergency department visits and services
- Laboratory services and diagnostic tests
- Home health services not covered under Part A
- Durable medical equipment and supplies
- Medical nutrition therapy
- Prosthetic devices

### Medicare Part C

- Programs that might help an individual to pay health care costs that Medicare does not cover\*

### Medicare Part D

- Prescription drug costs

\*More details can be found at: [www.medicare.gov](http://www.medicare.gov) in the Personal Plan Finder section.