

WCHM

WOUND CARE AND HYPERBARIC MEDICINE

VOLUME 7, ISSUE 3 — FALL 2016

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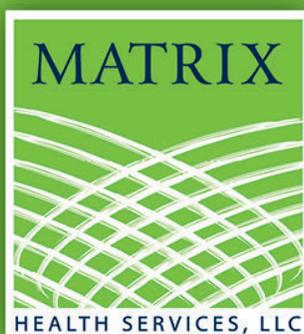
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NOTE FROM THE EDITOR

Thank you to all of our authors who help us understand key, critical issues in hyperbaric medicine and wound care in this fall issue of *WCHM*.

Does your clinical documentation support the medical necessity for hyperbaric oxygen services? Approved ICD-10-CM/PCS Trainer Gretchen Dixon answers this question in her Hyperbaric Oxygen (HBO) Therapy Services Webinar described in *WCHM*.

Current UHMS president, Dr. Enoch Huang, announces an emergency and critical-care hyperbaric oxygen symposium — the first of its kind — focused entirely on the use of HBO₂ for the emergency and critical-care patient.

Based on communications with Dr. Michael Strauss, Renée Duncan (UHMS communications coordinator) shares how updated assessment scoring improves upon existing wound score systems.

We welcome Laura Josefsen and Connie Hutson as they take us through the Baromedical Nurses Association's journey from 1985 to the present.

In the second part of her three-part series, Heather Hettrick

helps us understand and recognize lymphedema, a chronic, incurable disease that can be readily managed with the appropriate interventions.

The second of five articles from prolific contributor Dr. Strauss discusses the education aspects of the prevention of foot wounds and offers information about “do’s” and “don’ts” to prevent them.

Dr. Jayesh Shah concentrates on hyperbaric oxygen therapy as an advanced wound-care modality for specific wounds in his Q&A.

Please send any comments, articles, industry information, press releases, and updates to info@bestpub.com. Share *WCHM* magazine with colleagues and clients. Add your clinic to our Map of Wound Care and HBO Centers featured in *WCHM* and also at www.bestpub.com.

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Lorraine Fico-White
Managing Editor, *WCHM*

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The Sky Is Blue, the Wind Blows as Air Heals

Does your clinical documentation support the medical necessity for hyperbaric oxygen services?

By Gretchen Dixon, MBA, RN, CCS, CPCO, AHIMA Approved ICD-10-CM/PCS Trainer

The Hyperbaric Oxygen (HBO) Therapy Services Webinar provides detailed information on clinical documentation, ICD-10-CM (diagnosis) code selection and billing for this service. Due to the amount of information, the webinar is broken into three parts with the understanding of time constraints and for the convenience of the audience. Upon completion of the webinar, a self-assessment quiz is provided as a measurement of understanding this topic. After obtaining a satisfactory score from the quiz, you will be awarded either CMEs or CEUs.

This three-part webinar series will provide the audience with clinical documentation and coding details through the following objectives:

- Emphasize the need for detailed clinical documentation supporting medical necessity for HBO treatment by diagnosis.
- Recognize the complexity assigning ICD-10-CM codes.
- Review the common diagnoses covered by third-party payers.
- Understand the specific elements in treatment documentation to support billing of services.
- Be aware of anticipated or updated changes in the HBO treatment industry.

The following text are excerpts from the webinar with a few slides sharing the depth of information you will take away and be able to implement in real time on your next HBO clinical documentation improvement. You will also learn how to select the most accurate diagnosis code.

Documentation Principles

Slide 1 “Documentation Principles” identifies four key points for accuracy and clarity of clinical documentation details. Keep in mind the phrase “THINK-N-INK” when

providing clinical documentation while watching for electronic health record “note bloat,” otherwise known as junk verbiage. Often today our electronic health records (EHRs) lack an individualized patient’s progress story from visit to visit. This includes the overused activity within the EHR option of copying/pasting irrelevant clinical documentation from past visits into the present visit.

How familiar are you with the annual updates to the Official Guidelines for Coding and Reporting with a specific focus on outpatient services and the use of uncertain terms for a diagnosis? Verbiage such as “I think,” “maybe,” “thought to be related to,” “depends” and “possibly” are some terms that denote doubt or uncertainty in the mind of the provider. Such terms cannot be coded as if they exist in the outpatient arena per Section 4, Diagnostic Coding and Reporting Guidelines for Outpatient Services; Subsection H: Uncertain Diagnosis.

Documentation Principles = THINK-N-INK

- Provide accurate and detailed documentation in the HBO evaluation
 - Reason for the encounter or Chief Complaint provides the medical necessity by beginning the patient’s story.
- Educate all health care documenters to ensure the patient’s wound progress, response to and changes in treatment or revision in diagnosis is accurately documented
- Identify Risk
 - Change curve: add **why** the service is needed through clinical documentation details to eliminate vagueness
 - Weak documentation results in unspecified or weak ICD-10-CM codes
- Teach / mentor providers what is permissible according to the Official ICD-10-CM Guidelines for Coding and Reporting of Outpatient Services.

HBO and Prior Authorization

HBO therapy services provided to patients has entered into a period of intense monitoring involving prior authorization from both Centers for Medicare and Medicaid Services (CMS) and third-party payers. This is due to the investigative reports from the Office of Inspector General

WOUND CARE CERTIFICATION STUDY GUIDE

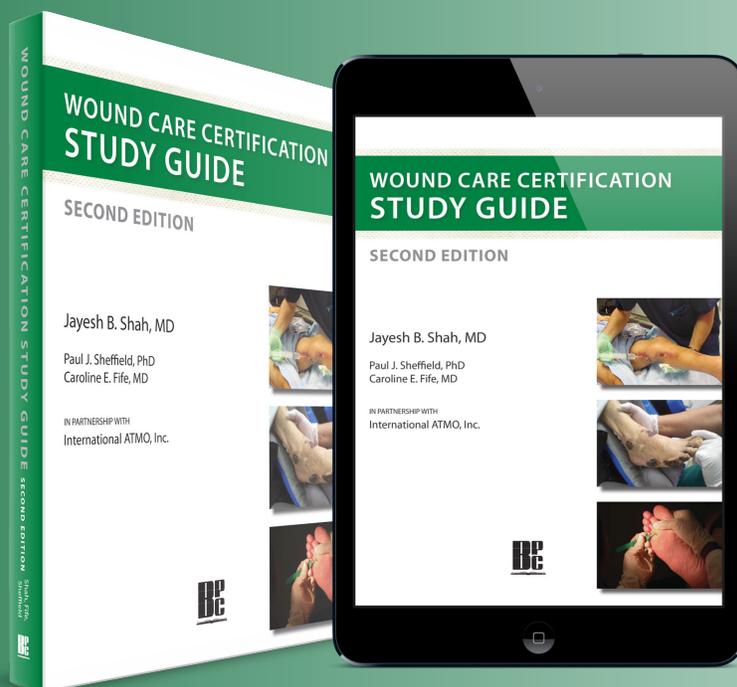
SECOND EDITION

DR. JAYESH SHAH, in partnership with **DR. PAUL SHEFFIELD** of International ATMO and **DR. CAROLINE FIFE** of Intellicure, has created the perfect tool for anyone studying to take a wound certification exam — AAWM, APWCA, CWCN, NAWC, and more.

Now in its second edition, the *Wound Care Certification Study Guide* is fully updated with the latest clinical practices and regulatory and reimbursement information. Drs. Shah, Sheffield, and Fife, along with numerous contributing authors who are considered experts in the field of wound care, have collaborated to create the best possible study resource for these important examinations. The content focuses on key information that wound care certifying agencies consider important in their examinations, with self-assessment questions at the conclusion of each chapter to help participants identify areas of comprehension and concepts that require further study.

This all-inclusive study guide includes:

- Thirty-three informative chapters that review the core principles candidates need to know to obtain wound care certification
- New chapter on hyperbaric oxygen therapy by Yvette Hall, Patricia Rios, and Jay Shah
- Added section on PQRS and quality reporting by Dr. Caroline Fife
- A full-length post-course exam complete with answers and explanations
- Comprehension questions with detailed answers at the end of each chapter
- More than 200 color photos, tables, and diagrams
- Clinical pathways with best practice recommendations for the practitioner
- New chapter on hyperbaric oxygen therapy and added section on PQRS and quality reporting
- Guidance on how to choose the certification



“It was my pleasure to review the second edition of the Wound Care Certification Guide. I found the chapters to be well written and organized, building upon the science of wound healing while including practical clinical applications and sample questions. This text should be useful to all wound care professionals, including the novice and expert alike. It will certainly be an important adjunct for anyone preparing for board examinations.”

— Robert J. Snyder, DPM, MSc, CWS; Professor and Director of Clinical Research, Barry University SPM; Past President, Association for the Advancement of Wound Care; Past President, American Board of Wound Management

“The manuscript is the result of a monumental amount of work. I congratulate all involved.”

— Terry Treadwell, MD, FACS; Medical Director, Institute for Advanced Wound Care



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(OIG) at the request of CMS who identified high potential concerns regarding medical necessity and improper payments regarding Medicare beneficiaries.

Although the OIG report was for the calendar year 2000, the data noted approximately \$14 million out of \$50 million was paid in error for Medicare beneficiaries who received HBO therapy for noncovered medical conditions or the clinical documentation did not adequately support the medical necessity of the outpatient service. In addition, approximately \$5 million was paid for treatments considered to be excessive. HBO therapy is now on the big map of medical service scrutiny.

Based on these findings, CMS instituted a Non-Emergent Hyperbaric Oxygen Therapy Prior Authorization Model implemented in three states in 2015. The OIG selected Illinois, Michigan, and New Jersey for the initial implementation of the model due to the two identified issues of high utilization and improper payment reimbursement.

Physician Evaluation Components

Initially, six diagnoses were listed for prior authorization; on December 28, 2015, however, CMS removed preparation and preservation of compromised skin grafts from the

list. This webinar discusses in depth the specific clinical documentation details that support the medical necessity for HBO therapy.

Slide 2 provides the audience two areas of weaknesses often found in the medical record history components of Chief Compliant and History of Present Illness clinical documentation. Does your patient's HBO evaluation include detailed clinical documentation? This webinar discusses each item in detail with real chart examples of accurate and inaccurate clinical documentation.

General Clinical Documentation Requirements

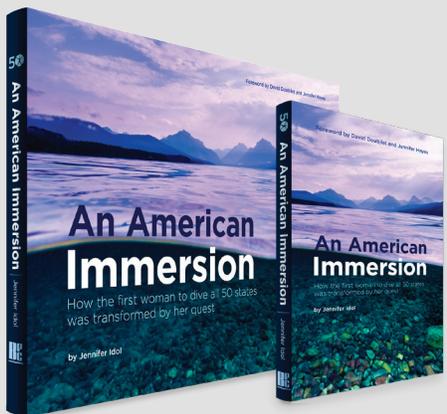
History Component includes:

- Chief Compliant (CC) / Reason for the visit stated in the patient's own words
- History of Present Illness (HPI)
 - ✓ Include the specific 8 elements which provide details to questions the provider asks the patient
 1. Location: Identify the site of the problem or symptom
 2. Context: Events describing the problem
 3. Duration: How long has the problem / condition existed?
 4. Quality: Describe or provide the characteristics of the problem
 5. Severity: What is the intensity, degree of the problem or symptom
 - ✓ Pain: rate of a scale of 1-10, describe the pain: stabbing, shooting, dull, sharp, etc.
 6. Timing: Regularity of occurrence when the problem occurs
 7. Modifying factors: What factors have been attempted to relieve/ exacerbate /not impact the problem?
 8. Associated signs and symptoms: other information details related to the reason for the encounter but does not fit in the other categories

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- Personalized Medicine: What does the HBO₂/WC practitioner need to know?
- Procedures and Payment in HBO₂ & Wound Care
- Common Mechanisms for the Effectiveness of HBO₂ in Disparate Diseases and Conditions
- Making sense of conflicting diabetic foot ulcers (DFU) literature
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— Don Barthelmess
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Marine Diving Technology Department

Hal Lomax ran his own diving business for a couple of decades and at the same time operated his own school, where he wrote all of the course material and texts. In 2006, he went back to work offshore as a freelance supervisor. He is a founding member of the Divers Association International and currently sits on the Board of Directors as board member for Canada. Since hanging up his helmet at the end of 2007, Hal has worked in various locations around the world as a diving superintendent and supervisor.



Osteoradionecrosis and Radionecrosis

Clinical documentation is often vague with limited details of the patient's past cancer treatments. A frequently used diagnosis is “radionecrosis of _____ (body part)” with ICD-10-CM code T66 selected. When reviewing the *ICD-10-CM Coding Manual* Tabular List of Diseases and Injuries there is an exclude item that directs the coder to another code selection. Without knowing the specific steps on how to manually select an ICD-10-CM (diagnosis) code but relying on the EHR Problem List, the selected code may not be the most accurate code for the HBO evaluation encounter. In this webinar we discuss the specific steps of selecting an ICD-10-CM code using real cases. **Slide 3** provides an excerpt from an *ICD-10-CM Coding Manual* for the code T66. How often have you selected this ICD-10-CM code? Does it feel right, or do you have doubt?

Osteoradionecrosis & Radionecrosis Trouble Finding Codes in ICD-10-CM

Step 2

In the *ICD-10-CM Coding Manual* turn to the **Tabular List** of Diseases and Injuries

- T66 -- Radiation sickness, unspecified
- ✓ **Excludes1** specified adverse effects of radiation, such as:
 - ✓ Excludes1 means “NOT CODED HERE”
 - ✓ burns (T20-T31)
 - ✓ leukemia (C91-C95)
 - ✓ radiation gastroenteritis and colitis (K52.0)
 - ✓ radiation pneumonitis (J70.0)
 - ✓ radiation related disorders of the skin and subcutaneous tissue (L55-L59)
 - ✓ radiation sunburn (L55.-)

Takeaways

Learn more by joining this three-part series on Hyperbaric Oxygen Therapy Services: Documentation, ICD-10-CM Coding and Billing Services at <http://woundeducationpartners.com/online-courses/browse-course-list.html>. You will challenge yourself to improve your clinical documentation and select more accurate diagnosis codes both supporting medical necessity and providing a defensible medical record for the services provided. The user-friendly information will improve your understanding of the coding applications, may provide answers to many of your coding questions, and reinforce your current knowledge of this topic.

At the end, you should have a clarified understanding of the value these sessions offer for those working in the wound-care environment. Mitigating possible denials or claim holds through accurate, clear, detailed, and cohesive clinical documentation is vital to ensure there is an even flow of revenue for services provided. Also, your improved clinical documentation provides a level of granularity and specificity for an accurate ICD-10-CM diagnosis(es) code(s), which supports the reason for the services provided to the patient.

There is a must for understanding the specific application of the current year's Official Guidelines for Coding and Reporting Outpatient Services as it relates to the bottom line of your department's operations. References are included for your personal library.

References

CMS Open Door Forum February 3, 2015, on Prior Authorization for HBO Therapy: https://www.cms.gov/Research-Statistics-Data-and-Systems/Monitoring-Programs/Medicare-FFS-Compliance-Programs/Prior-Authorization-Initiatives/Downloads/HBO_PriorAuthSlides_ODF020314.pdf

CMS Prior Authorization for HBO Fact Sheet: https://www.cms.gov/Research-Statistics-Data-and-Systems/Monitoring-Programs/Medicare-FFS-Compliance-Programs/Prior-Authorization-Initiatives/Downloads/HBOPriorAuth_ExternalFAQ_122815.pdf

Blue Cross and Blue Shield of Mississippi HBO Policy: [https://www.bcbsms.com/index.php?q=member-medical-policy-search.html&action=viewPolicy&path=%2Fpolicy%2Femed%2FHyperbaric+Oxygen+\(HBO\)+Pressurization.html](https://www.bcbsms.com/index.php?q=member-medical-policy-search.html&action=viewPolicy&path=%2Fpolicy%2Femed%2FHyperbaric+Oxygen+(HBO)+Pressurization.html)

Blue Cross and Blue Shield of California HBO Pre-Authorization Policy: <https://www.blueshieldca.com/provider/authorizations/forms-lists/prior-auth-list.sp>

Humana Commercial Preauthorization and Notification List January 18, 2016: <http://apps.humana.com/marketing/documents.asp?file=2772055>

Novitas Solutions, Medicare Prior Authorization for New Jersey: <http://www.novitas-solutions.com/webcenter/content/conn/>

UCM_Repository/uuid/dDocName:00133173
Optum 2016 ICD-10-CM Clinical Documentation Improvement Desk Reference ■

About the Author

GRETCHEN DIXON, MBA, RN, CCS, is the owner of Professional Compliance Strategies (PCS), LLC, and consults on outpatient departments and physician services. She has provided revenue-cycle compliance audits of services with a focus on wound care department operations for more than 10 years. She holds several credentials including an MBA in healthcare management, an RN with a practicing license in New York, and 23 multistate licensure from Virginia, AHIMA Certified Coding Specialist (CCS), AHIMA ICD-10-CM/PCS Approved Trainer, and is an AAPC Certified Professional (Healthcare) Compliance Officer. A longtime internal healthcare auditor, Dixon identifies issues through audits of D, C, B (documentation, coding and billing) of provided services. The outcome of each audit determines the topics of education to be provided to the staff and physicians, as she proactively believes education is the key to having complete, accurate, and consistent documentation supporting reimbursement for billed services. If you are interested in her services, contact Dixon at gmdixon@cox.net or call 1-615-210-7476.



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Emergency and Critical Care Hyperbaric Medicine in the United States

By Enoch Huang, MD

The field of undersea and hyperbaric medicine has gone through an evolution since the day six U.S. Navy officers established the Undersea Medical Society in 1967. At that time, the focus of the field primarily involved the treatment of emergencies — decompression sickness, arterial gas embolisms, gas gangrene, and carbon-monoxide poisoning. Over the next 50 years, the Undersea and Hyperbaric Medical Society (UHMS) has promulgated the use of hyperbaric oxygen (HBO₂) for many additional indications, and the field of hyperbaric medicine has grown to include more than the treatment of emergent indications. As the interest in using HBO₂ for nonhealing wounds increased, the number of facilities available for emergency and critical-care hyperbarics has dropped in recent years. There are numerous reasons for this:

- lack of physician interest in taking a call
- lack of reimbursement for taking a call
- lack of reimbursement for emergency/inpatient treatments
- higher risk of adverse outcomes
- lack of training and expertise in providing the service
- lack of equipment and facilities for providing the service

A recent study¹ showed that only 12% of hyperbaric facilities self-identified as being able to treat a patient with decompression sickness, arterial gas embolism, or carbon-monoxide poisoning if they were ventilated and required IV medications. A patient would have to be transported an average of 95 miles to be treated for these conditions.

While many of the issues underlying the decision not to provide 24/7 hyperbaric medical services are difficult to resolve, the UHMS continues to support the education and training of providers in the use of HBO₂ for the full range of hyperbaric indications. As part of this commitment, we are co-sponsoring ECCHO 2016 — an emergency and critical-care hyperbaric oxygen symposium — with Legacy Emanuel Medical Center in Portland, Oregon, on

November 5, 2016. This is the first symposium of its kind — focused entirely on the use of HBO₂ for the emergency and critical-care patient. The theme of this meeting is how to handle the practical concerns of treating sick patients in both monoplac and multiplac facilities. It boasts a world-class lineup of speakers from around the world, with plenty of time for panel discussion and faculty-attendee interaction.

Take advantage of this opportunity to meet world-renowned experts who have been providing this type of service for decades. Registration information can be found at: <http://www.legacyhealthevents.org/d/lvqk8t>.

References

1. Chin W., et al. (2016). Hyperbaric programs in the United States: locations and capabilities of treating decompression sickness, arterial gas embolisms, and acute carbon monoxide poisoning: survey results. *Undersea Hyperb Med* 43(1): 29-43. ■



About the Author

An active UHM reviewer, former chair of the UHMS Clinical Practice Guidelines Oversight Committee, and current chair of the Graduate Medical Education Committee, **ENOCH HUANG** is the current president of the UHMS and chair of the 2017 ASM program committee.





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UHMS Members Verify Reliability of Wound Score Tool

Updated assessment scoring improves upon existing systems.

By Renée Duncan,
Communications Coordinator, Undersea and Hyperbaric Medical Society

(Based on communications with Dr. Michael Strauss and from the paper "Reliability assessment of an innovative wound score," by Michael B. Strauss, MD; Hojin Moon, PhD; Jeremy A Busch, DPM; Christopher K. Jones, DPM; Lisa Nhan, DPM; Stuart Miller, MD; Phi-Nga Jeannie Le, MD; Wounds 2016: 28(6); 206-213)

UHMS member Dr. Michael Strauss and his colleagues at Long Beach Memorial Medical Center in Long Beach, California, are no strangers to the war on wounds. Their latest campaign is an updated assessment system developed by taking the best points of several other wound scoring systems and adding features they note will help better define scoring.

Its name: the [Long Beach] Wound Score, or [LB]WS.

"The [LB]WS is the first wound scoring system that has reliability and validation data to support its use," Strauss said in an email communication to the UHMS.

Strauss and colleagues have published a paper that describes the new system: "Reliability assessment of an innovative wound score," which appeared in the June 2016 issue of *Wounds* (*Wounds* 2016; 28(6):206-213). A subsequent article in progress will deal with the validation — i.e., outcome predictions — of the [LB]WS.

A number of wound scoring systems have been devised over the years to evaluate and treat wounds. The [LB]WS system operates before, during and after treatment and helps evaluate effectiveness of protocols in wound therapy.

The [LB]WS utilizes important features of existing systems, including the following:

- the Wagner grade for perfusion assessment

- the National Pressure Ulcer Advisory Panel (NPUAP) for depth assessment
- the University of Texas Health Science Center San Antonio Diabetic Wound Classification (UTDWC) for perfusion and infection plus depth assessments (which utilizes important components of the other three systems)
- the Infectious Disease Society of America (IDSA) Clinical Classification of a Diabetic Foot Infection for infection assessment

The [LB]WS system integrates their most important features and adds two extra parameters. In addition to assessment by

Of the 14 UHMS approved indications for the use of hyperbaric oxygen therapy, wounds have a starring role in the number of ailments in that list. Wounds cover a lot of territory because they play a large part in the development and subsequent treatment of indications such as gas gangrene, crush injury, compartment syndrome, arterial insufficiencies, compromised grafts and flaps, and intracranial abscesses.

Problem wounds — those that just don't heal as expected — represent a growing and significant challenge to our health care system. So it makes sense that new tools in the war against wounds are being developed and refined, particularly when it's done by health-care professionals who know the beneficial effects of hyperbaric oxygen in dealing with hard-to-heal wounds.

depth, degree of infection and perfusion, the [LB]WS adds assessment of wound size and appearance of the wound base to the essential features of the four existing systems. In addition, it grades each assessment on a continuum of severity.

Whereas the older systems are devoted mainly to evaluating diabetic foot ulcer (DFU), the [LB]WS is applicable for non-DFU as well as for those with diabetes who have wounds located in areas other than in the foot.

“The [LB]WS could be a very useful tool for wound management with respect to comparative effectiveness research (CER) — comparing treatment interventions for ‘like-for like’ wounds — and meaningful clinically important improvement, or MCII,” Strauss noted.

“We hope we can begin to answer vital questions as to whether the intervention truly changes the clinical course,” he said. “This has very important ramifications, especially for selection of wound dressing agents as well as hyperbaric oxygen usage.”

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of Pressure, the newsletter of the UHMS; www.uhms.org/publications/pressure.html. ■

About the Contributor

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Join us and see why the Undersea and Hyperbaric Medical Society remains the pre-eminent – and original – best source of diving and hyperbaric medicine information and education.

Baromedical Nurses Association: Then and Now

By Laura Josefsen, RN, ACHRN (Founding Member), and
Connie Hutson, ACHRN, CHWS, CWCN, RN, MS (Past President)

The Baromedical Nurses Association (BNA) was formally organized in 1985 by hyperbaric nurses who were leaders and pioneers in the hyperbaric industry. There was excitement in this new field, and goals were set with the intent to develop a strong infrastructure for this new organization.

The first goal was to develop a network for support and education for nurses going into this new nursing field. The needs of communication and working together were identified not only to advance the field of hyperbaric nursing but also for this new organization to be recognized

internationally as a credible and professional nursing organization.

In the very beginning the BNA set the groundwork to establish a code of ethics and recommended standards of practice for the hyperbaric nursing industry. It recognized the important role of nursing research and participated in education requirements for professional practice. A few years later, with the assistance of the National Board of Diving and Hyperbaric Medical Technology (NBDHMT), the BNA developed a certification process.

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Much was accomplished with little in 1985. During this era, typewriters (and pages of handwritten notes) were used to track the growing organizational progress and membership. The BNA did not have smartphones or computers and had no conference-call ability. The founding members used regular mail for sharing correspondence and ideas. Nursing was different at that time, and hyperbaric nursing progressed as nursing progressed.

The BNA has come a long way as an organization. It went through many stages of growth similar to the stages of life. The infancy stage was exciting — a time to learn and attempt new ideas. The adolescent stage was typically full of turmoil — changes were happening as technology evolved and new rules, guidelines, regulations and growth occurred. The adult stage became one of building and expanding on existing knowledge. The current stage is of celebration of where the BNA has been, where it is going, and the confidence to reach new levels.

BNA celebrated its 30th anniversary in 2015. This meeting was celebrated via a Caribbean cruise, which provided 12 continuing education units (CEUs) and a tour of the Cozumel Medical Center multiplace hyperbaric unit.

In 2015, the BNA purchased a new website to communicate with the growing membership. Through the website, the BNA was true to the mission of supporting nursing research and conducted its first electronic survey through Reg-on-Line. The survey was done with the cooperation of the NBDHMT, which looked at the incidence of decompression illness in the inside chamber attendant. The data are being statistically analyzed and should be presented soon.

There have been many changes over the years, but the BNA's philosophy has not changed. The practice of baromedical nursing is dynamic, complex and a challenging specialty in nursing. The BNA supports professionalism and works with other disciplines to offer total patient care to the hyperbaric oxygen (HBO) patient. Today, the BNA has members throughout the United States as well as in Europe, Asia, South and Central America and the South Pacific.

The BNA remains dedicated to advancing the field of HBO nursing and to provide the most up-to-date educational information supported by research. Educational opportunities and credits are offered free to members and at reduced cost to nonmembers through the website at hyperbaricnurses.org.

The BNA supports nursing research efforts, has a presence on committees and boards of national organizations to

have a public voice in issues affecting nursing and provides opportunities for networking and information exchange.

The newsletter and the president's message is available for viewing on the BNA website along with updated information as the BNA Board meets on a monthly basis via conference calls. The founding members are proud of how the board has embraced the digital age, with all paper documents stored digitally.

The BNA encourages you to visit the website and take advantage of the live webinars and recorded webinars worth valuable CEUs. It values the initial mission of communicating with hyperbaric nurses and welcomes comments from the field. Share your thoughts. You don't even need a postage stamp! ■

About the Authors

LAURA JOSEFSEN, RN, ACHRN,

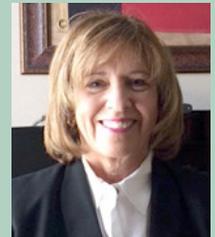
has been involved in the field of hyperbaric nursing since 1982. A founding member of the Baromedical Nurses Association (BNA) in 1985, she served as BNA president from 1996 to 1998 and as a board member in several positions throughout the years.



She served on the Undersea and Hyperbaric Medical Society (UHMS) Associates Council for six years, with two of those years as Nurse Representative on the UHMS Board of Directors. She has been a member of the UHMS Accreditation Team as a nurse surveyor, served for many years as an executive board member of the National Board of Diving and Hyperbaric Medical Technology and is a previous chairman of the BNA Certification Board. She is a member of the UHMS Associates, former member of Divers Alert Network, and former member of the Hyperbaric Technologists and Nurses Association (HTNA) of Australia. She has numerous publications and is an internationally recognized speaker in the field of hyperbaric medicine. Her passions are quality improvement and education to promote hyperbaric nursing, safety, and optimal standards of care and practice for patients and the community.

CONNIE HUTSON, ACHRN, CHWS, CWCN, RN, MS,

is a Regional Director of Safety for Healogics, Inc. and recently served as the Baromedical Nurses Association (BNA) president. She currently serves as the BNA Research Chair and as historian. Active in the hyperbaric industry for more than 16 years, Hutson is currently a member of the UHMS Associates and is a UHMS surveyor.



Prevention of New and Recurrent Foot Wounds

Part 2: Education

By Michael B. Strauss, MD; Anna M. Tan, DPM; Lientra Q. Lu

In Part 1 of this five-part series, we introduced the subject of the prevention of new and recurrent foot wounds and discussed and dispelled a number of misconceptions about foot wounds.¹ In this article we discuss the education aspects of the prevention of foot wounds and offer information about “do’s” and “don’ts” to prevent them. In no other aspect of medicine is the value of preventive medicine as tangible as in patients with diabetes in general, and in diabetics with foot problems in particular. In the USA, approximately one-third of diabetic treatment costs are spent on treating diabetic foot wounds.⁴ Education in the diabetic with foot problems is a “two-way street.” From one direction comes the advice from the patient’s physicians and associated care providers (Figure 1). The other direction is the patient’s

The value of proactive prevention of complications was conclusively demonstrated in the Diabetes Control and Complications Trial (DCCT) Research Group study.² The study showed that with optimal management of blood sugars through glucose monitoring and precise dosing of insulin, diabetic complications were reduced 50 to 75 percent as compared to the control group. Progression of neuropathy and ophthalmological angiopathy were the two elements monitored in the DCCT trial.

It is possible to reduce the occurrence of diabetic foot wounds to a similar extent when wound prevention strategies are employed.³ Prevention strategies start with patient education.

responses and compliance with the advice. Education is the key to preventing the 60 percent reported recurrence rate of healed diabetic foot ulcers in patients with a previous wound.^{5,6}

Patient education starts with the primary care provider. This level of care providers includes physicians, nurse practitioners, physician assistants and diabetic nursing educators. Three education goals from the educators in this role need to be achieved (Figure 2). They include the following: 1) ascertaining patient compliance, 2) instructing patients in

The foot is particularly prone to developing wounds because of its location and anatomy. With it being the most distal portion of the human body, it has the furthest distance for blood to travel from the heart to it than any other body structure. The first signs of peripheral artery disease are usually noted in the foot.

The foot, a relatively small structure compared to the overall body mass, transfers the entire body weight to the supporting surface when standing and walking. Thus, there is a force-concentration effect resulting in the propensity for pressure buildups under bony structures and deformities. When they exceed the integrity of the overlying soft tissues, foot ulcerations develop.

Anatomy-wise the foot is filled with tendons, ligaments, bones, joint capsules and neurovascular structures with a dearth of soft tissues such as muscle mantles and subcutaneous tissues. This increases its vulnerability to injury.

Finally, neuropathies usually first manifest themselves in the feet with losses of sensation, muscle imbalances leading to contractures and deformities, autonomic nervous system dysfunction causing dryness of the skin, soft tissue atrophy, and loss of proprioception. These changes make the skin more vulnerable to ulceration than would happen with equivalent stresses in patients without these problems. The neurological effects are usually found in combination with each other such that pain over a deformity that is amendable to surgical correction before a wound develops is not felt. This results in the patient delaying medical care until odor or drainage indicates that something is wrong.

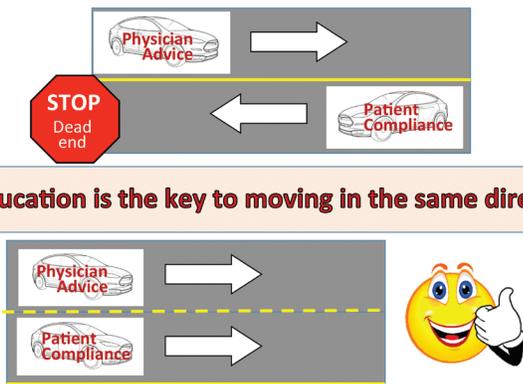
The terms *foot wounds* and *diabetic foot ulcers* (DFUs) need to be differentiated. Although common terminology for wounds in the feet of diabetics are reported as DFUs, we feel that this is not the most appropriate terminology. Foot ulcers suggest that they are superficial wounds that arise from shear stresses or pressure concentrations penetrating to only the subcutaneous tissue level. Wounds are a more generic term, can have many etiologies ranging from trauma to Charcot neuroarthropathy, and can involve deep tissues such as fascia, muscle, bone and joint.

do's and don'ts with respect to the foot, and 3) prescribing an appropriate activity level for the patient. The education objective for the patient with the potential for new or recurrent foot wounds is adherence to the recommendations of the primary care providers and the specialists who managed the wounds. The remainder of this part of our prevention of new and recurrent foot wounds series of articles will focus on the above three aspects of patient education.

Risk Factors for the Development of Foot Wounds

One of the first education considerations that primary care (PC) providers of diabetics need to be aware of is whether their patients have any of the risk factors for the development of foot wounds. The risk factors include deformity, peripheral artery disease, history of previous wound, previous amputation and neuropathy (Table 1).^{7,8} If one or more of these factors exists, the PC provider should inform patients of their increased risks for developing diabetic foot wounds. We have observed that the more risk factors present, the more likely wounds will occur. If any of the risk factors are

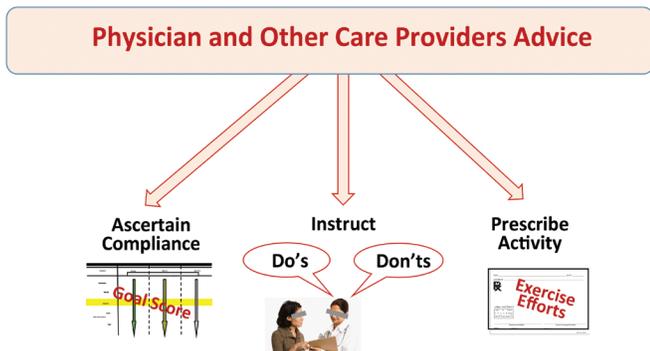
FIGURE 1. Physician advice and patient compliance can be a two-way street.



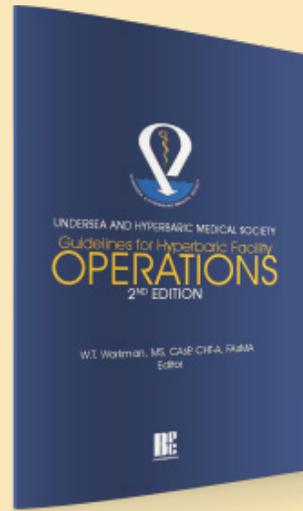
Education is the key to moving in the same direction

Legend: To be successful in preventing new and recurrent foot wounds, the physician and other care providers must be on the same "wavelength" as the patient. This is achieved through education. 60% recurrence rates of foot ulcers when not moving in the same direction.^{3,4}

FIGURE 2. Physician advice and patient compliance can be a two-way street.



Legend: The three components of patient education to prevent new and recurrent foot wounds. The education process starts with the primary care providers and is "fine tuned" by the specialist such as the cardiologist or the foot surgeon.



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present, it behooves the PC provider to not only discuss the significance of the risk factor with the patient but also inspect the feet. Other risk factors also need to be considered, including diabetes mellitus, obesity with or without the metabolic syndrome, smoking, malnutrition, immobility, and miscellaneous considerations such as infirmity, Alzheimer's disease, skin and soft tissue atrophy, and residuals of a stroke (Table 2). If skin attenuation, preulcerative lesions, soft tissue atrophy or diseased toenails are observed, the patient should be referred to a foot specialist for management. For preventive medical aspects as well as the prewound stage, management includes skin and toenail care, selection of protective footwear

and proactive surgeries. Each of these will be discussed in subsequent articles in this series.

New or recurrent foot wounds may be from direct or indirect causes (Table 3).⁹ Direct causes rapidly lead to foot wound problems and include inappropriate footwear, accelerated level of activity, sudden structural changes in the foot, or malunited fractures. Indirect causes are due to repetitive stresses in patients who have propensities for developing

TABLE 1. The five major risk factors for the development of extremity wounds

Factor	Concerns	Examples
Deformity	Concentration of stresses over bony prominences make the overlying skin vulnerable to breakdown	Erythema over bony prominences, callus formation, clawed toes, mal perforans ulcers, pressure, and tension ulcers/indolent wounds
Peripheral Arterial Disease	Insufficient to meet the increased (estimated to be 20-fold) requirements for wound healing and infection control	Wounds with ischemic bases, imperceptible pulses, and/or low transcutaneous oxygen measurements
History of Previous Wounds	This indicates that the patient is at risk for developing wounds. Usually other wound factor concerns coexist with this risk factor.	This risk factor is especially significant in those wounds that occurred spontaneously or without apparent injury.
Previous Amputation	Same concerns as listed above for history of previous wound	Amputations on contralateral extremity from toe to hip disarticulations as well as ipsilateral minor amputations of toes or partial foot
Neuropathy	Failure to recognize impending problems or delay in the diagnosis of frank wounds. Vulnerability to wound development due to skin dryness, atrophy, and muscle imbalances leading to pressure points, deformity, or contractures	Loss of sensation; ulcerations over apices, tips and clawed toes; mal perforans ulcers; and autonomic dysfunction

TABLE 2. Other risk factors for foot wounds

Condition	Associated Problems	Management
Malnutrition Monitored with weights, BMIs, albumin, and prealbumins	Insufficient protein stores for wound healing, dysphagia, mal absorption, edema	Food supplements, nasogastric tube feedings, percutaneous endoscopic gastrostomy, hyperalimentation
Obesity Weights, BMIs	Metabolic syndrome (obesity, hyperlipidemia, hypertension, pre-diabetes) Mobility Wound management, especially protection and off-loading	Diet Gastric bypass Exercise (6 hours of moderate exercise to lose one pound!!!)
Smoking	Tissue hypoxia Endothelial damage from chemicals in smoke Cancers Increased complication in surgery (wound dehiscence, wound sloughs, and infections)	Smoking cessation Nicotine patches Varonidine (Chantix®)
Infirmity	Pressure sores Anorexia Incontinence Cognitive function decrements	Activity Medications Off-loading/ Protective bedding Nutrition support
Advancing Age	Compliance Blunted immunological responses Impaired circulation	Same as for infirmity above
Diabetes Mellitus HbA1c	Vascular diseases Kidney diseases Visual problems	Glucose monitoring, insulin and other anti-hyperglycemic agents
Arthritis	Osteoporosis Fragility fracture Restricted mobility	Medications (non-steroidal inflammatory agents, bisphosphates) Joint replacements



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CHERRY RED

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— Michael Bennett, MB BS, MD, Conjoint Professor, University of New South Wales, Sydney, Australia, Department of Diving and Hyperbaric Medicine



About the Author:
Dr. Neil Hampson, a Seattle native, is a retired pulmonary, critical care, and hyperbaric medicine physician. He has an international reputation in hyperbaric medicine, specifically in the area of carbon monoxide poisoning. During his clinical career, he treated more than 1,000 patients with carbon monoxide poisoning and published numerous papers in medical journals about the condition.

wounds, including those with risk factors as well as venous stasis disease, abnormal weight-bearing mechanics from structural changes of the foot after surgery, loss of normal tissue elasticity from scar tissue, glycosylation of soft tissues, abnormal gait patterns secondary to neurological deficits, overloading especially associated with contralateral lower-limb problems, obesity and collagen vascular diseases.

Quantifying Compliance in Patients with the Propensity to Develop Foot Wounds

The second education goal of the PC practitioner as well as the physician managing the patient's wound care is to ascertain the patient's compliance. Compliance is an indicator of how well the patient follows instructions and guides the provider for determining what wound dressing agents should be used and how often the patient needs to return for follow-up evaluations after a wound heals. We quantify compliance with a user-friendly 0- to 10-point (best possible) Goal Score generated by summing five assessments each graded from 2 points (best) to 0 points (worst) (Table 4). Even though the Goal Score has five assessments, with compliance being one of the five, information from the other assessments supplements the compliance determination and helps to make decisions about management and follow-up. For the Goal Score we grade compliance as "Satisfactory" (2 points), "Partial" (1 point) and "absent" (0 points). The 0- to 2-point assessment is determined by what compliance consideration is the most seriously violated.

When we graded five systemic elements and five wound-care elements reflecting compliance on 0- to 2-point (best) scales, the "splitter-type" data added no better information than the user-friendly "satisfactory," "partial" or "absent" compliance determination from the Goal Score (Table 5).

How does compliance information aid in the education process? First, it helps in making decisions about treatment strategies, especially the protection/stabilization and wound dressing selection ones. If compliance is full, then weight-bearing and wound-care instructions are likely to be done without deviations. If compliance is poor, that is 0.5 or 0 on the 0- to 2-point compliance assessment, then casting (with windows for wound care) to protect and immobilize the wound

Strategies for managing the problem wound have been discussed in the first author's preceding articles in *Wound Care and Hyperbaric Medicine*.¹⁰⁻¹⁸ The five strategies include appropriate management of the wound base, stabilization and protection of the wound site, optimal medical management, proper selection of wound dressing agents, and attention to wound perfusion-oxygenation needs.

and simplified, infrequent wound dressings utilized can be done periodically in a clinic or by a home health-care service. This may not be the optimal care for the patient's wound but is the necessary one for the patient's compliance grade.

Usually quick observations make it possible to determine the compliance grade. For example, a morbidly obese patient would be graded low in compliance. Inspection of the feet for skin and toenail care instantaneously provides information as to compliance. Dry scaly skin found at return visits after the patient (or their aids) have been instructed in foot hygiene and lubrication indicates some compliance, while the presence of plaques and scales justifies a 0-point grade of this compliance consideration.

Second, the compliance assessment helps in making decisions about how frequently the patient with the healed wound needs to return for follow-up visits to ensure no new or recurrent wounds develop (Figure 3). For patients with a 0.5 or 0 grade, the follow-up visits need to be frequent, perhaps once or twice a month. For the middle group with partial compliance (1 point on the compliance assessment), visits can be spaced out to quarterly. Finally, in the fully compliant patient, yearly follow-up visits or returns on an as-needed basis are appropriate. At return visits the feet need to be examined for structural changes, recurrence of callus, attenuated skin sites as well as whether or not adjustments or replacement of protective footwear is needed.

Instructing the Patient in the Do's and Don'ts for Preventing New or Recurrent Foot Wounds

There are a number of recommendations that patients who have the propensity to develop foot wounds need to follow. Most are easy to follow and take only a moment's time to do. They are as important to foot-wound prevention as blood-glucose monitoring and insulin dosage are for preventing complications of diabetes. It is important for the PC providers and other caregivers who help with management of the wound to communicate the instructions to prevent new or

TABLE 3. Direct and indirect causes of foot wounds

Causes	Mechanisms	Onset
Direct Causes		
<ul style="list-style-type: none"> Inappropriate footwear Increased level of activity Sudden changes in the appearance of a foot deformity Charcot neuroarthropathy insufficiency fractures Trauma 	Acute single or closely repetitious stresses on a bony prominence or deformity	Etiology and onset usually easy to establish.
Indirect Causes		
<ul style="list-style-type: none"> Risk factors for wounds Abnormal loading/ gait to foot Post-operative structural changes of foot Loss of tissue elasticity from scar tissues Glycosylation of soft tissues Overloading Obesity Collagen vascular diseases Venous stasis disease ulcers Skin and soft tissue atrophy 	Repetitive stresses in feet vulnerable to developing wounds	Usually obscure onset Neuropathy obscures pain symptoms Muscle imbalances and loss of proprioception cause increased contact pressures.

TABLE 4. Goal Score

Assessment	Satisfactory 2 Points	Partial 1 Point	Absent 0 Points
Comprehension How well patient understands problem	Use half points if mixed or intermediate between 2 grades		
Motivation How strongly patient feels about healing the wound and/or avoiding major amputation			
Compliance How well patient follows instructions			
Support Family, caregiver, institutional			
Insight Appropriateness of decision making			

Note: The "Goal Score" is another useful tool to determine how successful and how intent the patient and the family are in healing a wound and avoiding a major amputation. Goal Scores greater than 4 points supports the decision to avoid lower limb amputation and do everything possible for wound salvage. This score coupled with the Wellness Score (Table 2) provides objectivity to recommend management of limb-threatening wounds.

recurrent foot wounds. Although it is important that the patient is aware of all of the do's and don'ts of foot-wound prevention, some of them have more pertinence than others. This is where knowing the patient is more important than knowing the disease so that at follow-up visits only the crucial do's and don'ts are reinforced. Likewise, the patient's compliance as discussed above will determine how often the do's and don'ts need to be reinforced at follow-ups.

There are several levels of responsibility for doing this. The PC provider is the first level of the hierarchy in educating the patient about the do's and don'ts. Next comes the wound-care specialists and surgeons who directly deal/dealt with the wound problem. The diabetic nurse educator can bridge the gap between the PC and wound-management providers to focus on the pertinent do's and don'ts for the particular patient. Finally, but probably at the top of the list, is the patient and/or their care assistants who have the 24/7 responsibility for preventing new or recurrent foot wounds.

Ten Important Patient Do's for Preventing Foot Wounds

1. Be aware of the risk factors that are predispositions to foot wounds. These include deformities, peripheral artery disease, history of a previous wound, prior amputation, and/or neuropathy (Table 1).

Rationale: Self-awareness and self-reliance are fundamental to maintaining good health, and the prevention of foot wounds is no exception.

Remember: The time the patient spends with a physician or other health-care provider is almost infinitesimal compared to the time between visits. If the patient does not bring a wound problem or risk factor to the attention of the health-care provider, it will not likely be checked.

Most foot problems are remedial, and the sooner they are addressed, the easier they are to manage. Many problems

when first recognized can be managed in the office with protective footwear and/or simple surgeries.

2. Make your primary-care provider aware of your goals to keep your feet healthy and your desire for immediate referral to a foot specialist if and/or when needed.

Rationale: In the majority of cases, management of foot problems that have the potential for becoming wounds can be done before serious problems arise.

Remember: With time constraints and the need for efficiency, the foot exam or questions about the healthiness of the feet may be overlooked unless concerns are specifically expressed to the primary-care physician.

3. Those patients with one or more risk factors need to inspect each foot and healed wound site daily after removing shoes.

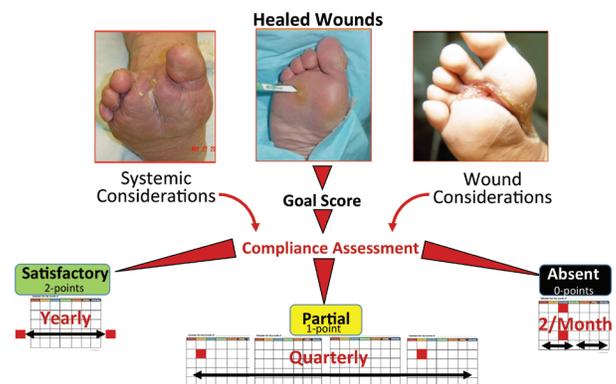
Rationale: The earlier a wound or potential wound is recognized, the easier it is to manage and the faster it can be resolved.

Remember: Use good lighting, wear glasses if needed for viewing small objects, and use a mirror if there are problems with agility to see the bottoms of the feet. Check for pressure areas (signaled by erythema), irritated areas with superficial abrasion of the skin, calluses, dry skin, scaling, plaques, cracks and fissures in the skin, blisters, corns, and deformities.

4. Inspect socks daily for stains; always wear white socks if risk factors for foot wounds are present.

Rationale: With sensory neuropathy, the first sign of an impending wound problem, namely pain, may not be appreciated. Stains as occurring with blister formation of a wound may be the first clue that something is wrong. Almost any stain will be noted on white socks.

FIGURE 3. Compliance as a guide to determining the need for follow-up evaluations of the healed foot wound



Legend: The compliance assessment of the Goal Score is a useful guide for gauging the frequency of return visits after a wound heals. This is especially true for patients who have systemic or previous wound care considerations regarding compliance. See Table 5 for specifics of systemic and wound considerations for measuring compliance.

Remember: Stains on socks are a sign that the skin integrity of the foot has been disrupted. To disregard this sign is tantamount to denial that a problem exists. The cause of the stain should always be identified and the problem addressed immediately.

5. Practice good foot skin hygiene daily.

Rationale: The skin is the first “line of defense” for the prevention of foot wounds. The healthier the skin is, the more it can tolerate insults that lead to wounds. Simple skin cleansing and lubrication measures are a first step to ensure the health of the skin of the feet.

Remember: Attention to foot and leg skin care is as important for preventing skin complications of these structures as blood-sugar monitoring and management is to preventing complications of diabetes (Figure 4).

In addition, the quality and consistency of foot care is a measure of patient compliance.

6. Perform appropriate toenail care.

Rationale: Toenail problems are commonly associated with diabetic foot wounds. This will be discussed further in Part 3 of this series. As in skin care, toenail management can be used as another measure of compliance (Figure 4).

Remember: Only the simplest of toenail care measures should be done by the patients themselves, especially if the toenails are diseased, neuropathy is present, agility problems (insufficient flexibility to position toes in a safe position to trim) exist and/or vision is impaired.

7. Wear appropriate footwear to accommodate your foot problems.

Rationale: The more severe the foot deformities, the more specialized the protective footwear requirements are. A future article in this series will further discuss this subject.

FIGURE 4. Inadequate skin and toenail care



Legend: Above photos of patients who obviously have not practiced the “do’s” of skin and toenail care. Initiation of care should be done by the primary care providers and taught to the patient. The less compliant the patient, the more frequent return visits are needed to reinforce this and do the interventions required to prevent new and recurrent foot wounds.

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Remember: Appropriate prescriptions for footwear require knowledge of the underlying problem — i.e., the biomechanics. Hence the more complicated the problem, the greater the need for the footwear prescription to be written by wound-care providers with expertise in foot problems.

8. Check shoes and orthotics periodically for signs of wear or poor fit.

Rationale: Footwear and orthotics lose their stabilizing ability with activity and use. In addition, the shape of the patient's foot may change with time and progression of the problem as is frequently observed in patients with Charcot neuroarthropathy. With loss of footwear protection and stabilization, recurrent or new wound problems, stress fractures and/or new deformities may arise.

Remember: The time the patient spends with a PC provider or other health-care provider is very little compared to the time between visits. Hence, the patient and/or his/her attendants are usually the first to recognize these problems and bring them to the attention of the primary-care providers and foot specialists.

9. Walking and other exercise activities should be selected based on the patient's capacity to do them safely as determined by the PC providers but often in collaboration with specialists such orthopaedists (for bone and muscle functional considerations) and cardiologists (for heart matters).

Rationale: Exercise has many benefits such as improving cardiovascular fitness, enhancing stamina, complementing weight reduction, augmenting mobility, preventing osteoporosis, and stimulating angiogenesis.

Remember: Exercise regimens need to be tailored to the capabilities of the patient and will be discussed further in the next section of this article.

10. Optimize body weight and body mass index.

Rationale: Obesity complicates almost every medical problem. With respect to foot problems, each additional pound of weight multiplies stresses across the foot by a factor of three or more when walking (Figure 5).

Wound care can be very challenging in the morbidly obese patient. Casts and orthotics may be difficult, if not impossible, to fit. Non-weight bearing on the injured extremity even for transfers may be impossible.

Remember: Weight reduction is a challenging problem. The PC physician should initiate diet programs with help from the clinical nutritionist. Minimally invasive surgical techniques add a new dimension for surgical management of obesity.

Ten Important Patient Don'ts for Preventing Foot Wounds

Many of the don'ts are a specific consequence of neuropathies and failure to recognize the warning signs of new or impending injuries. All patients who have risk factors for wounds and/or have had a serious wound, especially in the feet, need to heed the following don'ts with respect to foot wound prevention.

1. Don't walk barefoot.

Comment: Sharp objects or rough surfaces can cause wounds in the feet. Foreign objects such as needles may penetrate the skin of the foot. The injury may go unnoticed until drainage, odor or both are noted. Sensory neuropathy may disguise the pain.

Factors that interfere with infection control — such as diabetes, peripheral artery disease, collagen vascular diseases, atrophic skin and deformities — may allow infections to develop, whereas a wound would not occur in people without these problems.

2. Don't soak the feet in hot water.

Comment: Although foot hygiene starts with cleansing, two factors make the patient with risk factors for wounds particularly susceptible to burn injuries of the feet. First, a sensory neuropathy may prevent patients from recognizing the magnitude of the heat stress and fail to warn them to cease the exposure.

Second, heat exposures, which would not ordinarily cause burns, may lead to burns in patients with peripheral artery disease. These patients do not have the ability to dissipate heat at the same rate (via blood circulation) as patients with normal perfusion.

3. Don't use heat on the feet.

Comment: This don't is a corollary to the preceding one. Strong admonitions need to be given to patients who use heating pads or hot-water bottles to warm their feet because of poor circulation. If these devices are used, patients should be instructed to select only low temperature settings or use warm (not hot) water temperatures. For added safety, if electrical devices are used, they should have timer switches to limit the durations of exposure.

4. Don't use chemicals or sharp objects to trim calluses.

Comment: These items may cause wounds. Because they are not sterile, there is the possibility for infections to develop if the skin integrity is broken. Chemicals harsh enough to eradicate calluses will cause damage to the adjacent skin should they come in contact with it.

FIGURE 5. The adverse effects of weight on the foot

Force translated through the foot with walking is approximately 3-X the body weight

- This is due to the acceleration effect ($F = ma$)
 - And multiplied by the mass ($F = ma$)
- i.e. force = mass X acceleration



Legend: The foot and ankles are remarkable structures. They transmit the entire weight of the body with standing and walking through the smallest portions of the lower extremities. Because of force effects (mass x acceleration), each pound of body weight increases the forces between the foot and the underlying support surfaces by a threefold factor

Furthermore, with impaired agility and/or vision, difficulties in adequately trimming the callus (or applying the chemical debriding agent) may occur. Too little trimming will not be adequate to offload the underlying deformity. Too much trimming will penetrate the skin surface and lead to bleeding and possible infection.

5. Don't trim the edge portions of toenails that are embedded into the skin.

Comment: The embedded ends (medial and lateral portions of the distal margins) of toenails, especially the hallux nails, thicken, accumulate debris and grow into the underlying soft tissues. This becomes a precursor for ingrown toenails and paronychia (infection of the toenail margins from the edges of the toenail penetrating the skin).

Expertise in toenail care and appropriate instruments are required to manage debris at the toenail margins as well as dystrophic, dysmorphic, thickened, and fungus-infected nails.

6. Don't assume a new pair of shoes, even from a footwear prescription, will fit properly.

Comment: Even though protective footwear may be specially prescribed, it may not always fit perfectly. In addition, a period of adjustment to new shoes should always be recommended in those patients who have neuropathy in their feet. In such situations, the new shoes should be worn for only a few minutes initially; then the feet should be inspected for pressure areas, blisters and erythema.

Typically, there is a "break-in" period for new shoes in which the materials stretch and accommodate to the wearers' feet. This is why a "go slow" admonition should always be given to each patient who gets a prescription for new protective footwear to not discard the old shoes until the new shoes are fully adjusted.

In about half the patients with new protective footwear

prescriptions, subsequent adjustments to the footwear are required. This is not a sign of improper prescriptions, but rather it reflects the challenges that the patient's feet present.

7. Don't use toenail polish if there has been a previous history of toenail problems.

Comment: Toenail polish, lacquer or acrylic generates an impermeable barrier over the toenail. The polish not only may hide underlying toenail problems that require special care but also may prevent air from getting to the toenail surface. The drying effects of air may prevent toenail infections since fungus infections thrive in moist environments.

8. Don't wear constricting bands around the feet and ankles or rings on the toes.

Comment: These devices may interfere with circulation. More commonly, the constricting bands interfere with venous and lymphatic return, causing swelling distal to the constriction. Consequences may lead to pressure areas with shoe wear leading to blisters and ulcerations. If the swelling is severe enough, it may also interfere with the arterial blood supply and can lead to gangrenous changes, especially in the patient who already has poor circulation.

Indentations from the elastic bands at the proximal margins of socks suggest the bands are too tight. Corrective measures include wearing stockings with uniform compression or cutting the elastic bands at the top of the socks. If indentions are observed in sock wear, it is an indication to use elastic support hose.

Socks that are too tight over the toe areas may cause pressure on the toenails. This can contribute to the development in ingrown toenails.

9. Don't wear inappropriate shoes.

Comment: Shoes with pointed toes, as considered fashionable by some, narrow the forefeet. Acutely this can lead to pressure sores. With extended use, deformities such as hallux valgus and bunions are prone to develop.

TABLE 5. Supplemental compliance measures

Systemic Components to Measure Compliance	Local Wound Components to Measure Compliance
1. Glycemic control	1. Dressing change
2. Exercise/ Activity	2. Off-loading
3. Diet (Obesity)	3. Skin/ Toenail care
4. Smoking History	4. Edema control
5. Medication Adherence	5. Follow-up exams

Likewise, high-heel shoes should be avoided. These concentrate pressures in the forefoot, especially the metatarsal heads, and narrow the toes into a spear shape with weight bearing. Consequences are the development of bunions and hallux valgus, calluses under the metatarsal heads, pressure atrophy of the metatarsal fat pads, hyperextension of the metatarsophalangeals joints of the toes, proximal retraction of the toes on the dorsum of the forefoot, pressure forces on the toenails, and shortening the Achilles tendon mechanism.

10. Don't smoke.

Comment: The harmful effects of smoking tobacco in general, and for wound healing in particular, have become well publicized. More than 4,000 harmful substances have been identified in tobacco smoke. Nicotine causes narrowing of the arteries. Other substances such as carbon monoxide and tars cause damage to blood vessels.

Studies show that tobacco smokers have double the complication rates from surgeries as do nonsmokers. Many surgeons, especially for elective cosmetic procedures, refuse to operate on patients who smoke tobacco.¹⁹

Since smoking tobacco interferes with oxygen delivery to tissues, it is important for patients with risk factors for foot wounds, especially those with peripheral artery disease, to not smoke.

Choosing Appropriate Activities to Prevent New and Recurrent Foot Wounds

The third component of patient education is the selection of appropriate activities for the patient's level of function. It is essential to consider the patient's capacity for activities when prescribing recommendations about appropriate activities for patients who have risk factors for foot wounds. Activity level can be placed on a spectrum from unlimited, such as in world-class athletes, to none, as in a bed-ridden patient who requires total assistance for all activities of daily living. The Wellness Score is another tool to quickly assess the functional capacity of the patient and make recommendations for activity (Table 6). The ambulation assessment of the Wellness Score provides a benchmark for patients' activities and is graded on the 0- to 2-point scale like other assessments. A score of 2 points indicates the patient is capable of doing community ambulation; 1 point, household ambulation; and 0 points, no ambulation. Half points are used if intermediate between two levels, and a half point is subtracted if aids are required.

Other components of the Wellness Score provide supplemental information for the activity "prescription." For example, patients with cardiac comorbidities may need to limit activities that do not overly stress their heart. Patients

TABLE 6. Wellness Score

Criteria	2 Points	1 Point	0 Points
ADLs <small>Ability to do activities of daily living</small>	Full	Partial	Helped for all
Ambulation	Community	Household	None
Comorbidities <small>Except neuro; include obesity</small>	Normal	Impaired	Decompensated
Tobacco/Immuno-suppressors	None	Past use	Current
Neuro Function	Normal	Impaired	Decompensated

Note: Subtract ½ point if mixed or between 2 point grades
 Subtract ½ point if aids needed for ambulation (e.g. canes, crutches, walkers, wheelchair, scooters, or motorized wheelchairs)
 Do not consider neurological deficits in the comorbidities assessment since neuro-function is a separate assessment in itself
 Malnutrition and obesity should be included in the comorbidities assessment

with paraplegia may be community ambulators with a wheelchair. Because of the need for the wheelchair, their ambulation assessment grade would be 1.5 points rather than 2 points. Patients with foot deformities and/or profound sensory neuropathies should be advised against doing running activities for exercise.

The question is raised: Should diabetics with peripheral sensory neuropathy run marathons? We feel it is inadvisable because of the prolonged repetitive stresses to the insensate foot that could lead to foot ulcers. The possible exception is the "proven" athlete who runs regularly, uses optimal footwear for running, has a deformity-free foot and has not had a history of previous foot wounds. In such cases, short races up to 10 kilometers are probably OK. We feel it would be ill-advised, however, for a diabetic with total sensory neuropathy to run longer-distance marathons.

Naturally, there is more to exercise and activity than ambulation level alone. Patients with risk factors for foot wounds and/or low assessment grades on other components of the Wellness Score who are capable of exercising should be encouraged to do so. The three cardinal components of an exercise program are muscle stretching and joint ranges of motion, resistance exercise to increase strength, and cardiovascular conditioning (Table 7). Exercise recommendation should be made by the PC providers and in collaboration with the foot specialist if a foot problem was managed previously by the specialist. Ideally, the initial activity program should be supervised by a physical therapist. The patients and their assistants should then be instructed in the procedures they can continue after the supervised course of therapy is completed.

Finally, patient education should conclude with rehabilitation expectations. After prolonged periods of immobilization as often required with wound healing

TABLE 7. The three cardinal components of an exercise program

Component	Goals	Methods	Examples	Concerns
Stretching	Improved mobility, agility, and flexibility	Range of motion (ROM) activity of joints Gentle stretching beyond endpoints	Assisted and active assisted ROMs Passive ROM and stretching	Muscle tears Joint subluxations, dislocations Fragility fractures
Strengthening	Improved muscle tone and strength	Resistance training activities	Weight training using barbells/ dumbbells/ elastic bands Pull-ups, sit-ups, push-ups, etc.	Muscle strains, tears, and ruptures Joint injuries leading to arthritis Bursitis
Cardiovascular Conditioning	Stamina and endurance	High-repetition, low-resistance exercises	Walking, treadmill, swimming, jogging, etc.	Cardiac events, e.g. ischemia, infarction Stress fractures

in patients with comorbidities, mobility may be slow to return. The older the patient and the lower the Wellness Score (Table 6), the slower the progress is likely to be. Physiological age, however, is more important in making recommendations for activity. When providing directions for rehabilitation of a patient with a foot wound, the physiological age becomes the important determinant in what the patient can and should do. Even though progress may be slow, patients should be encouraged to have a positive attitude regarding regaining functional activity. It takes about a year for a patient with a below-knee amputation to plateau with respect to functional recovery. Information such as this can be used to reassure the patient discouraged with his/her slow rehabilitation progress after the healing of a foot wound. This is part of the educational process for the healed foot wound patient.

Chronological age is the age based on the patient's birthdate. Physiological age reflects a patient's activity level, cognitive function, and health as compared with a person of a different age. Consequently, the physiological age may be much lower than the chronological as an 80-year-old who runs marathons. Conversely, it may be much higher as in a 50-year-old with coronary artery disease requiring supplemental oxygen to remain comfortable.

Conclusions

Patient education is fundamental for the prevention of new and recurrent foot wounds. There is probably no other medical situation in which there is such a close relationship between recognizing the potential for a foot wound problem and being able to educate how to prevent it from happening. With such objectivity, the 15-minute visit with the care provider every couple of weeks during healing of the foot wound and at longer intervals (depending on the patient's compliance) after the wound is healed can be a very effective use of time when the three components of this article are used as a guideline. The components are recognition and mitigation of risk factors, do's and don'ts with respect to protecting the foot from wounds, and selecting appropriate activity. This is epitomized by

the quotation, "To educate is wonderful, to use what is learned is sublime." The real success stories in problem wound management and prevention are those in which the patients, their families and/or their care assistants apply what has been taught to them.

Fifteen minutes of contact with a physician every two weeks represents 0.074 percent of the total time in this interval, whereas a visit once every three months represents only 0.012 percent of the time.

This information emphasizes the crucial nature of what happens between medical checks is largely the determining factor for success or failure to prevent new and recurrent foot wounds.

The 15-minute visit needs to be focused to ensure the patient and his/her caregivers are doing the right thing to prevent foot wounds and if not, then be instructed in what they should do.

The "common sense" approach to patient education is strongly recommended. Rather than just telling patients and their family or assistants what to do and what not to do, it is better to explain the reasons for the advice. The starting point for this explanation are the rationale, things to remember, and comments portions of the do's and don'ts recommendations. Certainly not all patients will understand and remember this information. The comprehension assessment (i.e., satisfactory, partial or absent) of the Goal Score quantifies how well the patient understands this information and guides the PC providers and wound-care specialists how to direct their advice during return visits. Sublimity (of outstanding and/or exalted worth and value) in terms of wound prevention may be equated to the state in which the patient and his/her assistant understand and fully comply with the education given to them by their medical and surgical care providers.

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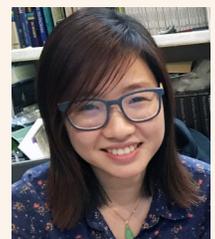
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Understanding and Recognizing Lymphedema

If you know what to look for, you will find it.

By Heather Hettrick PT, PhD, CWS, CLT-LANA, CLWT

Lymphedema is a chronic, incurable disease that can be readily managed with the appropriate interventions. It is a vascular disorder that is either due to congenital malformations of the lymphatic system (primary etiology) or related to an insult or injury to the lymphatic system (secondary etiology) such as surgery, trauma, radiation, malignancies or infections.

The clinical course of lymphedema involves a progressive swelling of the limb or areas affected due to a mechanical insufficiency of the lymphatic system. Over time, this protein-rich fluid burden may lead to various integumentary complications ranging from fibrosis and hyperkeratosis to weeping skin with or without ulceration.

The challenge is to appreciate the magnitude of those affected by both lymphedema and integumentary dysfunction. Even though millions are affected by various forms of lymphedema worldwide, the existing literature fails to fully define the population-based prevalence, health outcomes, and treatment costs of this disorder. This information is even harder to obtain or quantify for lymphedema patients with associated integumentary complications.

Although evidence-based, best-practice guidelines have been outlined in consensus documents that lymphedema is a relatively underrecognized condition in both medical and public domains. The reasons for this include a lack of public awareness of the condition, insufficient education and knowledge among health-care providers regarding its etiology and management, and limited reimbursement coverage to support lymphedema care models.¹ This is further compounded by the fact that patients with integumentary dysfunction are also faced with the same limitations. Although highly interrelated, lymphedema and integumentary dysfunction have traditionally been taught, researched and even managed separately. Progress has only recently been made addressing the interdependent nature of these conditions.

A rough population prevalence rate for chronic nonhealing wounds in the United States is 2% of the general population;² this translates to roughly 7 million individuals. A conservative estimate of the cost of caring for chronic wounds exceeds \$50 billion per year.³⁻⁵ The majority of chronic nonhealing wounds involves peripheral vascular disease (arterial and venous insufficiency). Estimated prevalence reports of chronic venous insufficiency vary geographically (highest reports in western countries) and range from < 1% to 40% in females and from < 1% to 17% in males.⁶ To gain perspective, 20-30% of patients with advanced chronic venous disease will have associated lymphatic dysfunction believed to be related to overload from the fluid burden, damage from venous hypertension and repeated infections (cellulitis).⁷⁻⁹ This form of lymphedema is referred to as phlebolymphe-
dema (see Photo 1).



PHOTO 1: Integumentary dysfunction associated with lymphedema: phlebolymphe-
dema. (Photo copyright AAWC, used with permission for educational purposes.)

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With respect to lymphedema, it is estimated that 3-5 million people in the United States alone suffer from this disease, yet it is likely that estimate is not truly reflective because many remain undiagnosed and/or underreported. More data are available on lymphedema secondary to various forms of cancer. The overall risk for lymphedema for all cancers is reported to be 15.5%.¹⁰ Specifically, lymphedema is reported to occur in up to 49% of breast, 20% of gynecologic, 16% of melanoma, 10% of genitourinary and 6% of head and neck cancer patients after lymph node dissection and/or radiotherapy. Additionally, 10% of patients who receive isolated axillary sentinel lymph node biopsy report subjective symptoms of lymphedema.¹⁰⁻¹⁷ On a global scale, the leading cause of lymphedema is due to lymphatic filariasis, a parasitic form of lymphedema spread through mosquitos. More than 1.2 billion people are at risk for contracting lymphatic filariasis (LF), which is one of 13 neglected tropical diseases and one of only six infectious diseases considered eliminable by the World Health Assembly. This disfiguring and debilitating disease affects more than 120 million people in 83 countries. (See Photos 2-3.)

To understand lymphedema, it is important to appreciate the function of the lymphatic system. In addition to immune defense, the basic purpose of the lymphatic system is to facilitate fluid movement from the interstitial tissues back to the venous circulation to help maintain a normal fluid balance. The lymphatic system has four major roles:

1. Fluid in the interstitial spaces is continuously circulating. As plasma and plasma proteins escape from the small



PHOTOS 2-3: Lymphatic filariasis

blood vessels, they are picked up by the lymphatic system and returned to the blood circulation. The lymphatic system reabsorbs/ transports substances that the venous system cannot through the mechanisms of Starling's law/ equilibrium.

2. The lymphatic system acts as a safety valve for fluid overload and helps keep edema from forming. As the interstitial fluid increases, the interstitial fluid pressure increases, which causes an increase in the local lymph flow. The local lymph system can be temporarily overwhelmed by sudden local increases in the interstitial fluid and pitting edema will result (as in the case of a sprained ankle).
3. The homeostasis of the extracellular environment is maintained by the lymphatic system. The lymphatic system removes excess protein molecules and waste from the interstitial fluid. The large protein molecules and fluids that cannot reenter the circulatory vessels gain entry into the blood circulation through the terminal lymphatics.
4. The lymphatic system also cleanses the interstitial fluid and provides a blockade to the spread of infection or malignant cells in the lymph nodes.

There are two main classifications of lymphedema: primary and secondary. Primary lymphedema is caused by developmental abnormalities of the lymphatic system, such as incomplete development of lymph vessels, reduced number or absent lymphatic structures, enlarged and incompetent vessels, or fibrosis of lymph vessels and nodes. Congenital lymphedema occurs within first two years of life, lymphedema praecox before age 35, and lymphedema tarda after age 35.¹⁸

Secondary lymphedema is more prevalent than primary lymphedema. A number of risk factors can contribute to the development of secondary lymphedema. Classification of causes include trauma and tissue damage, malignant disease, venous disease, infection, inflammation, endocrine disease, immobility and dependency, and factitious.¹⁹ Risk factors that can lead to secondary lymphedema include but are not limited to breast, head and neck, uterine and prostate cancer; chronic venous insufficiency; deep vein thrombosis (DVT); thrombophlebitis; vein stripping or harvesting; hysterectomy; orthopedic surgery; obesity; cellulitis and wound infections; chronic wounds; orthopedic injuries; burns; scarring; immobility from advancing age or hemiparesis; congestive heart failure; and renal insufficiency.¹⁹ Factors that complicate the care of a patient with lymphedema include peripheral arterial disease, obesity, diabetes, neuropathy, limited mobility and strength, difficulties with activities of daily

living, financial constraints, depression, social isolation, lack of family support for long-term management, and other psychosocial factors.

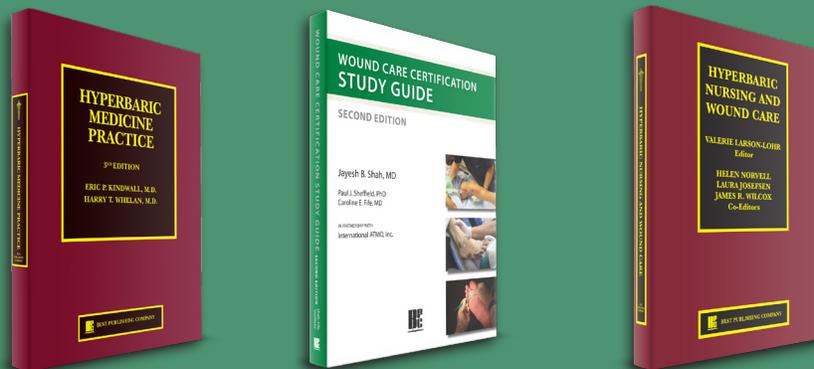
The current staging system for lymphedema is rudimentary at best. Further work is needed to create a lymphedema severity score that will provide a better assessment of the complexities of each patient. The International Society of Lymphology (ISL) lymphedema staging system is as follows:

- **Stage 0:** This is the latency stage. Risk factors and comorbidities are present. Swelling is not yet evident despite impaired lymph transport. There are subtle changes in tissue fluid/composition and changes in subjective symptoms. Stage 0 may exist months or years before overt edema occurs (Stages I-III).
- **Stage I:** This stage represents an early accumulation of fluid relatively high in protein content, which subsides with limb elevation. Pitting may occur. An increase in various proliferating cells may also be seen.
- **Stage II:** In this stage, limb elevation alone rarely reduces tissue swelling, and pitting is manifest. Late in Stage II, the limb may or may not pit as excess fat and fibrosis develop.

- **Stage III:** This stage encompasses lymphostatic elephantiasis where pitting can be absent and trophic skin changes such as papillomatosis and hyperkeratosis are present. Further deposition of fat and fibrosis and warty overgrowths may have developed.²⁰

The ISL staging system does not reflect lymphedema severity in terms of volume of the limb. For example, within Stage III, one patient may have severe skin changes, massive enlargement of the extremity and large, overhanging lobes of hardened, fibrotic tissue. This patient may require many months of intensive treatment and more than one staff member to treat the limb, and fitting for long-term compression can be complex. In contrast, another patient may have minimal increase in limb size but with focal areas of advanced skin changes, resulting in classification of the lymphedema as Stage III.

Within each Stage 0–III, the severity of lymphedema can also be graded according to percent volume difference between limbs: minimal = <20% volume increase, moderate = 20%–40% volume increase, and severe = >40% volume increase.¹⁸ This can be calculated if only one arm or leg is affected, however, and is difficult to objectively measure in other areas of the body.



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Complete decongestive therapy (CDT) is considered the standard of care for lymphedema management. The focus of CDT is to achieve a reduction in limb volume and improve the quality and integrity of the skin. CDT is typically divided into two phases: an intensive phase and a maintenance phase. The intensive phase is best performed daily (or as frequently as possible) until maximal volume reduction is achieved. Once the lymphedematous limb has plateaued and is no longer achieving a reduction in volume, the patient is transitioned into the maintenance phase, which is continued for life.

Throughout both phases of CDT, patient education is paramount because self-care is critical for successful long-term outcomes.²¹ Although there is no cure for lymphedema, it is a disease that can be successfully managed, improving function and quality of life.

CDT involves the following components that are guided by a trained lymphedema specialist during the intensive phase:

1. meticulous skin and nail care of the affected areas
2. approximately 60 minutes of manual lymph drainage (MLD), a gentle manual technique that helps redirect lymph flow
3. multilayer, short-stretch compression bandaging
4. therapeutic exercises to promote lymphatic pumping
5. diaphragmatic breathing to stimulate the thoracic duct (largest lymph vessel of the body)
6. over-the-counter or custom compression garments once the limb has decongested

All aspects of CDT continue during the maintenance phase with a few modifications. The maintenance phase is also patient-directed and is necessary for lifelong management of lymphedema. Compression garments are worn during the day followed by short-stretch bandaging or the use of a proper compression system at night. Compression garments or systems can employ different closure mechanisms (such as Velcro), assisting the patient with donning and doffing and often, improving adherence with use.

Proper identification and diagnosis is essential for patients with lymphedema. Recognizing the predisposing risk factors, signs, and symptoms of lymphedema will assist with differential diagnosis when faced with complex patient presentations. Many patients with lymphedema have concomitant comorbidities, which may complicate medical management. It is imperative to appreciate all contributing factors to individualize interventions and modify treatment approaches as applicable. Chronic wounds directly or indirectly related to lymphedema are not uncommon. Proper management involves addressing the underlying



Initial Visit



3 months later

PHOTO 4: Lower-extremity lymphedema before and after a few months of CDT (Photo copyright AAWC, used with permission for educational purposes)

medical conditions or diseases that may be the likely cause of ulceration, while simultaneously addressing skin and nail care and providing proper complete decongestive therapy, modified according to the patient's specific needs, clinical presentation, and functional impairments. Referral to a certified lymphedema therapist and/or trained physician specialist is of utmost importance. (See Photo 4, which depicts lower-extremity lymphedema before and after a few months of CDT.)

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Q&A: Using Hyperbaric Oxygen Therapy as an Advanced Wound-Care Modality

By Jayesh B. Shah, MD, CWSP, UHM

The following Q&A is taken from Chapter 26, “Hyperbaric Oxygen Therapy” (by Yvette Ponce-Hall, CHT; E. Patricia Rios, RN, MSN, CHRN-C; and Jayesh B. Shah, MD) in the *Wound Care Certification Study Guide*, 2nd edition (Jayesh B. Shah, MD; Paul J. Sheffield, MD; and Caroline E. Fife, MD, editors). This chapter discusses the use of hyperbaric oxygen therapy (HBOT) as an advanced wound-care modality for specific wound types. Readers should be able to describe how HBOT works, identify approved indications or contraindications to therapy, recognize any potential side effects from receiving therapy, and understand the importance of safety and emergency protocols.

QUESTIONS

- 1. A febrile patient is at the greater risk of which of the following while in the chamber?**
 - a) nitrogen narcosis
 - b) oxygen toxicity
 - c) anemia
 - d) barotrauma
- 2. Which item must be completed prior to the start of a hyperbaric treatment?**
 - a) hyperbaric risk assessment
 - b) patient orientation and instruction
 - c) physician orders, which specify hyperbaric treatment protocol
 - d) all of the above
- 3. When it comes to fire safety, which of the following is always the main priority?**
 - a) patient diagnosis
 - b) hyperbaric risk assessment
 - c) prevention
 - d) Navy diving protocols
- 4. In the case of a seizure in the chamber, the chamber should be decompressed once the patient is in the tonic phase.**
 - a) True
 - b) False
- 5. A class B chamber is classified as a hyperbaric chamber that is meant for which of the following?**
 - a) animal use only
 - b) multiple human occupancy
 - c) single human occupancy
 - d) commercial divers
- 6. When a suspected pneumothorax occurs, the chamber operator should do which of the following?**
 - a) Stop travel, ascend slowly, notify physician, and assess the patient.
 - b) Notify physician and nurse, stop travel, maintain depth until directed to terminate treatment, and ascend slowly under supervising physician’s direction.
 - c) Stop travel, maintain depth until directed to terminate treatment, notify physician and nurse, and ascend slowly under supervising physician’s direction.
 - d) Stop travel, notify physician and nurse, maintain depth until directed to terminate treatment, and ascend slowly under supervising physician’s direction.
- 7. Which of the following is not a UHMS-accepted hyperbaric oxygen therapy indication?**
 - a) compromised grafts and flaps
 - b) cerebral palsy
 - c) osteomyelitis (refractory)
 - d) necrotizing soft tissue infections

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ANSWERS

1. b) Vital signs should be taken prior to hyperbaric treatment to determine the patient's stability. Patients with a temperature greater than 101°F are at greater risk of having a seizure in the hyperbaric chamber. The supervising physician should consider an antipyretic prior to treatment.
2. d) All of the above apply to an initial start of hyperbaric treatment. Patients should be informed of the risks and benefits of the treatment. An orientation should consist of a description of the chamber's environment as well as a clear list of approved and prohibited items in the chamber. Patients should have a basic understanding of how the hyperbaric oxygen treatments assist with accelerated healing. A hyperbaric risk assessment should be completed by the nurse or hyperbaric physician. Any contraindications should be addressed by the hyperbaric physician prior to the start of treatment. Finally, there should be clear and concise physician orders written that specify the indication for treatment, the treatment protocol, and the number of treatments ordered.
3. c) Prevention is the main priority in fire safety. A safety checklist should be completed prior to the patient's entrance into the chamber. All potentially hazardous items should be prohibited from entering the chamber. If there is ever a doubt about an item, it is best to prohibit it from entering the chamber. Remember, "If in doubt, leave it out."
4. b) Never decompress a patient who is in the tonic phase. The chamber operator, under the supervision of the attending physician, must wait until the patient resumes normal breathing and completes the tonic phase of seizure before starting the ascent (decompression) of the chamber. Due to Boyle's law, barotrauma can occur from the increase of volume within the lungs during the decompression of the chamber.
5. c) A class B chamber is commonly referred to as a monoplace chamber. These chambers are meant for only single human occupancy.
6. d) In the case of a suspected pneumothorax, the chamber operator should first stop travel. While the chamber pressure idles, the hyperbaric physician and nurse may be notified. The chamber operator must maintain depth until directed by the physician to terminate the treatment. This time could be used to prepare for the removal of the patient. A code team, crash cart, and chest tube cart could

be retrieved during this time. Once the physician gives the order, slowly decompress the chamber.

7. b) Although hyperbaric oxygen studies have been performed on cerebral palsy patients, it is currently not a UHMS-approved indication.

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