

# Wound Care

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C A N A D A

THE OFFICIAL PUBLICATION OF WOUNDS CANADA

**Wound Care  
Certification  
for Canadian  
Nurses**

**Wound Sleuth X 2:  
Test Your  
Knowledge**

A Primer on  
**Charcot  
Neuroarthropathy**

The  
Science Behind

**ABPI**

**PLUS! A Bonus  
ABPI "How-to" Tool**

**The Power  
of Protein in  
Wound Healing**

# RECOGNIZING HS

## DO YOU RECOGNIZE PATIENTS WITH HIDRADENITIS SUPPURATIVA (HS)?



**DR. NEIL SHEAR**

Head of Dermatology, Sunnybrook Hospital

"People with HS come to the emergency room in severe pain and discomfort requiring assistance with the draining of the boils during a flare-up. It's not unusual for patients to go home undiagnosed."



**DR. RALPH GEORGE**

Associate Professor, University of Toronto,  
Division of General Surgery



**DR. VU KIET TRAN**

ER physician at University Health Network

"HS is a chronic, painful, inflammatory skin disease that affects 1-4% of the general adult population. It is characterized by boils usually occurring where certain sweat glands are located, such as under the breasts, buttocks, and inner thighs."

"There is currently no cure for HS. Early diagnosis and proper management is important for a patient's quality of life. The first step for those with HS is to speak to their dermatologist to get an accurate diagnosis."

To learn more about HS from these specialists, go to [www.RecognizingHS.com/WCC](http://www.RecognizingHS.com/WCC)

## WHEN YOU SEE THESE LESIONS, DO YOU SUSPECT HS? DO YOU ASK ABOUT RECURRENCE?



Photo compliments of Dr. Afsaneh Alavi.



Photo compliments of Dr. Marc Bourcier.

## ASSESSING PATIENTS WITH RECURRENT BOILS

Most HS cases can be recognized with high reliability by the presence of 3 main features:<sup>1-3</sup>

1. **Typical lesions:** nodules, sinus tracts, abscesses, scarring
2. **Typical anatomical location:** axilla, groin, genitals, under the breasts, others (perianal, neck, abdomen, buttocks)
3. **Relapses and chronicity:**  $\geq 2$  times per 6 months

Questions to ask your patients with suspected HS:<sup>2</sup>

1. Have you had outbreaks of boils during the last 6 months?
2. Where were the boils and how many did you have?

To confirm an HS diagnosis,  
please refer your patient to a dermatologist.

**References:** 1. Zouboulis CC, et al. European S1 guideline for the treatment of hidradenitis suppurativa/acne inversa. *JEADV* 2015;29:619-44. 2. Lockwood SJ, et al. Diagnostic workup. In: Kimball AB, Jemec GBE, eds. *Hidradenitis Suppurativa: A Disease Primer*. Cham, Switzerland: Springer; 2016:27-37. 3. Poli F, et al. Clinical presentation. In: Jemec GBE, Revuz J, Leyden JJ, eds. *Hidradenitis Suppurativa*. Berlin, Germany: Springer; 2006:11-24.

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Wounds Canada ([www.woundscanada.ca](http://www.woundscanada.ca)) is a non-profit organization of health-care professionals, industry participants, patients and caregivers dedicated to the advancement of wound prevention and care in Canada.

Wounds Canada was formed in 1995 as the Canadian Association of Wound Care. The association's efforts are focused on four key areas: education, research, advocacy and awareness, and partnerships.

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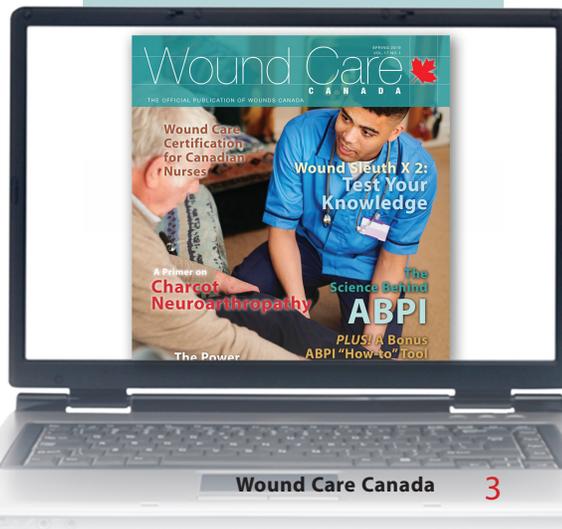
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## Don't Miss Out

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**It's free!**





# News in Wound Care

## Wounds Canada News

Wounds Canada is off to a busy start in 2019, working on organizing conferences, publishing resources like Best Practice Recommendations and *Wound Care Canada*, adding educational programs to the online Wounds Canada Institute suite, and more! Keep reading for more information about each of these initiatives.

## 2019 Conferences and Other Live Educational Events

The line-up for 2019 so far covers a range of topics and formats, allowing individuals to choose the program that best suits their current learning needs.

### April 11, Halifax, NS: Skin and Wound Care for Unregulated Care Providers

An interactive half-day event that builds on the content of select Wounds Canada Best Practice Recommendations (BPR) documents. Case studies and discussions will explore risk factors for skin damage, common prevention measures, presentation and causes of common types of skin damage such as pressure injuries, incontinence-associated dermatitis and foot fungus, and strategies for managing skin damage as an unregulated care provider.

### April 11, Halifax, NS: Focus on the Prevention and Management of Venous Leg Ulcers: Knowledge and Skills

An interactive one-day event that builds on the content of Wounds Canada's Best Practice Recommendations for the Prevention and Treatment of Venous Leg Ulcers. This program provides the opportunity to refine fundamental skills relevant to the assessment and management of venous leg ulcers, such as ankle-brachial pressure index



testing, monofilament testing, gait assessment, assessment of ankle and leg range of motion (ROM), selection and application of compression wraps and garments and ROM exercises.

### April 12–13, Halifax, NS: 2019 Wounds Canada Spring Conference

A two-day continuing education event designed to support health-care professionals from a variety of disciplines who work with patients with wounds or who are at risk for developing wounds, with sessions delivered by regional, national and international experts.



### April 13, Halifax, NS: Wound Care for Primary Care Practitioners

An interactive half-day event that builds on the content of select Wounds Canada Best Practice Recommendation documents. Case studies and discussions will address differential diagnoses and common misdiagnoses as well as strategies for prevention and management for a variety of wound types.

### May 31, Toronto, ON: New Perspectives in Diabetic Limb Preservation Symposium

A one-day learning event that will include sessions on the medical management of persons with diabetic foot ulcers, vascular considerations, infection, wound management, offloading, the challenges of renal patients and more, delivered by regional, national and international experts. This event is a joint venture between Wounds Canada and the Canadian Podiatric Medical Association and is supported by the Division of Vascular Surgery at the University of Toronto.

## October 3–6, Niagara Falls, ON: 2019 Wounds Canada Fall Conference

Canada's largest wound-related event; four days of sessions, networking opportunities, poster presentations and access to industry partners for health professionals from a variety of disciplines.



Details about these and other programs are listed on the [Wounds Canada](#) and [Wounds Canada Institute](#) websites, and new programs are added regularly, so check in often to see what's new.

## Wounds Canada Publications Best Practice Recommendations

A French version of Best Practice Recommendations for the Prevention and Management of Skin Tears has just been released and is available for download [here](#).

Wounds Canada is publishing two BPRs in English this year: Best Practice Recommendations for the Prevention and Management of

Venous Leg Ulcers and Best Practice

Recommendations for the Prevention and Management of Arterial Ulcers. Stay tuned for more information about publication dates.

To view the complete suite of BPR documents, [click here](#).

## Wound Care Canada

The next issue of *Wound Care Canada* is scheduled for release in June 2018. Don't miss an issue; [click here](#) to join our email list. To view archived issues of this publication, [click here](#).

## The Wounds Canada Institute

The Wounds Canada Institute offers self-paced online and in-person learning opportunities for those wishing to improve their knowledge and skills in the areas of skin health



and wound prevention and management. The formats and variety of programs on offer allow students to engage in the type of education best suited to their current level of expertise, specific interests, time availability and resources. For a complete list of programs currently offered, [click here](#).

## NEW! Introducing Wounds Canada Institute's new program, Focus on the Prevention and Management of Skin Tears: Knowledge (A104MWN).

This program is aimed at nurses and allied health-care professionals. The program is based on the concepts and content in the Wounds Canada document, Best Practice Recommendations for the Prevention and Management of Skin Tears, and provides students with the most recent information in a form they can immediately use at the bedside.

This self-paced program, which includes two online modules and an interactive webinar, is now available on the [Institute website](#).

## Coming soon! Online version of Wound Care for Primary Care Practitioners

An online version of our popular Wound Care for Primary Care Practitioners, allowing busy professionals to access the modules any time from anywhere, is in the works. Stay tuned for launch date.



# It's never just a skin tear

How do you prevent, assess and manage skin tears?



Join a live and interactive one hour educational webinar

Thursday, April 18<sup>th</sup>, 2019  
1:00 pm Eastern Time

Global expert and past ISTAP President **Dr. Kimberly LeBlanc** PhD, RN, NSWOC, WOCC (C), IIWCC, leads a comprehensive discussion to help you further develop your expertise in treating and protecting your patients from skin tears.



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## News from Our Industry Partners

### Hydrofera Blue CLASSIC Dressings

A recent meta-analysis of nine studies involving 185 chronic wounds found that 78.2% of those wounds contained bacterial biofilm. Biofilms in wounds are known to form on, and associate with, slough and devitalized tissue. Hydrofera Blue CLASSIC dressing manages exudating wounds and aids in the removal of devitalized tissue from the wound bed. As this action occurs, Hydrofera Blue CLASSIC dressing helps disrupt biofilm that is associated with slough and devitalized tissue. Learn more at [www.hydrofera.com](http://www.hydrofera.com).

### The geko™ Wound Therapy Device: Faster Recovery and an Estimated Cost Savings of \$2,500 Per Patient

This wireless, wristwatch-size device enables the body's mechanisms to promote wound healing by activating lower-leg muscle pumps. Stimulation of the common peroneal nerve results in increased blood volume and velocity in the veins and arteries and perfusion in the microcirculatory system. This translates into about 60% of the blood flow generated by continuous walking.

With five peer-reviewed papers published, the geko™ device is attracting attention across Canada as an innovative tool to improve circulation, promote wound healing and reduce edema. A recent Ontario evaluation with new venous leg ulcer (VLU) patients demonstrated a cost savings of approximately \$2,500 per patient while significantly shortening healing time. Learn more at [www.gekowound.ca](http://www.gekowound.ca).





# Wound Sleuth

By R. Gary Sibbald, BSc MD MEd DSc (Hon) FRCPC (Med)(Derm)  
FAAD MAPWCA JM, Patricia M. Coutts, RN IHWCC and Reneeka  
Persaud-Jaimangal, MScCH MD

## An Ulcerated Scalp

Mrs. D is a 70-year-old female who was first seen in 2005 for ulcerations on her scalp. At that time the four areas of ulceration were pustular, moist, mildly itchy and increasing in number and size, although not painful. She has a history of asthma, osteoporosis, complete hair loss, thyroid surgery, recurrent scalp infections (often with methicillin-resistant *Staphylococcus aureus* [MRSA]), actinic keratosis (red, scaly, precancerous lesions), and has had a basal cell carcinoma removed from her face (2007). She wears a hairpiece to cover her hair loss.



### Questions for the Reader

**Q** What is the cause/diagnosis, and how would you investigate this patient?

**A** Mrs. D had radiation to her scalp, in Italy, at four years of age to treat a fungal infection (possible tinea capitis)—at a time when there was no effective systemic or topical therapy for this condition. There is limited evidence to support the effectiveness of radiation ther-

apy for human tinea capitis.

These areas of ulceration are caused by late radiation changes associated with thinning of the skin, and loss of skin appendages (hair follicles, sweat glands), along with the risk of local inflammation, infection and malignant transformation. A skin biopsy to rule out other diagnoses should be performed along with blood work and an X-ray of the scalp to rule out infiltration in the scalp from malignant transformation or contiguous osteomyelitis.

**Q** What other diagnoses/causes would you consider?

**A** There are a number of other conditions you might consider. See Table 1: Differential Diagnoses for a list.

### Management

These wounds were classified as maintenance wounds, because some areas would close and others remained open. Biopsies were required for lesions sus-

**Table 1:** Differential Diagnoses

Lesion	Clinical Characteristics & Treatment
Basal cell carcinoma	<ul style="list-style-type: none"> <li>• Easy bleeding, telangiectasia (fine thread-like blood vessels, pearly borders and possible central ulceration).</li> <li>• Requires removal.</li> </ul>
Squamous cell carcinoma	<ul style="list-style-type: none"> <li>• Keratin associated with depth of the margin and may have a cutaneous horn protruding from the surface.</li> <li>• Requires removal.</li> </ul>
Actinic keratosis	<ul style="list-style-type: none"> <li>• Red, scaly lesions that can be thin and easily palpated.</li> <li>• Thick lesions may be associated with a cutaneous horn.</li> <li>• Atypical cells and can progress to squamous cell.</li> <li>• Requires observation, cryotherapy, chemical treatment, surgical removal.</li> </ul>
Psoriasis of scalp	<ul style="list-style-type: none"> <li>• Silvery scale and underlying erythema that spreads discretely beyond the scalp.</li> <li>• Requires treatment with topical corticosteroids, retinoids, medicated shampoo, coal tar, ultra-violet light. Systemic treatment includes oral or injected medications such as corticosteroids, retinoids, biologics.</li> </ul>
Seborrheic dermatitis	<ul style="list-style-type: none"> <li>• Fine greasy scale and underlying erythema in scalp, eyebrows and facial creases.</li> <li>• Requires anti-seborrheic shampoo, topical steroids.</li> </ul>
Chronic cellulitis	<ul style="list-style-type: none"> <li>• Painful erythema and swelling, warm to touch, may have exposed bone.</li> <li>• Requires oral antibiotics (generally that target gram-positive and gram-negative bacteria), severe cases require intravenous antibiotics. May also need appropriate wound care measures depending on the presentation</li> </ul>
Local infection – Critical colonization	<ul style="list-style-type: none"> <li>• Non-healing ulcer, exudate, red, friable granulation, debris, odour.</li> <li>• Requires topical treatment with ionized silver, delayed-release iodine, PHMB/chlorhexidine, crystal violet and methylene blue foam.</li> </ul>

picious of malignancy. An anti-inflammatory antibiotic (doxycycline) was prescribed. For an effect against methicillin-resistant *Staphylococcus aureus* (MRSA), the doxycycline was administered in a dose of 100 mg twice daily with anti-inflammatory effects at doses of 40 to 100 mg.

For local wound care, the area was cleansed with a chlorhexidine solution (a mouth-wash with a water base, used off label because there is no stinging or burning effect), and the open areas were covered with a non-adherent dressing containing slow-release povidone-iodine, and a second-

ary non-adherent dressing was held in place with a soft silicone tape. This enabled the patient to wear her wig comfortably. Debridement of crust was performed on an as needed basis. 5-fluorouracil topical cream, a false nucleotide that interferes with DNA as an anti-neoplastic agent, was recommended as an option for the topical treatment of potential premalignant actinic keratoses and superficial basal cell carcinoma. This cream was applied twice a week to identify and remove any potential superficial skin cancers.

The patient actively performs regular skin checks and applies sun protection.

## Conclusion

Mrs D's case illustrates the importance of a detailed history and addressing the patient's concerns, in addition to treating the wound. Due to her history of radiation treatment during childhood, which created a large amount of scar tissue, she needs to be monitored for secondary complications: infection, persistent inflammation or malignant transformation. Her scarring and non-reversible hair loss have had a significant impact on her physical and emotional well-being, but she is grateful for the long-term support from her husband and health-care providers. 🇨🇦

# Bookmark the date!

**PLAN AHEAD FOR THE 2019 FALL CONFERENCE**



**Niagara Falls 2019**

**Fall  
Conference**

**NIAGARA FALLS**

**ONTARIO**

**OCTOBER 3-6**

Fallsview Casino Resort and  
Hilton Fallsview Hotel & Suites



# The Science Behind ABPI

By Pamela Houghton, PT PhD

*This article describes the research underlying each of the common ways an ankle brachial pressure index (ABPI) test is used in the assessment and management of people with chronic leg ulcers due to mixed arterial/venous insufficiency. It is hoped that an understanding of what research has and has not been done to validate different uses of an ABPI will help clinicians select when and where to use the test and how to interpret and make appropriate clinical decisions.*

**T**he ankle brachial pressure index (ABPI), sometimes also called ankle brachial index (ABI) is an example of a diagnostic test used commonly in wound care practice. It compares systolic pressure measured in the brachial artery to that measured in an artery located near the ankle, with the expectation that values derived from the arm and leg should be similar, yielding a ratio near 1.0 (see subsequent article for the steps involved in performing an ABPI). Determination of ABPI in normal healthy volunteers between the ages of 20 and 40 years yielded ABPI values between 1.05 and 1.2.<sup>1</sup>

To complete an ABPI (see page 22 for an illustrated how-to), a portable ultrasound Doppler is used to amplify the sound emitted by pulsatile blood flowing through larger arterial vessels. According to a historical review by Nayman in

1979, Strandness and colleagues were the first to apply an ultrasound Doppler in conjunction with a blood pressure cuff to detect people with stenosis or occlusion of larger arteries located in the periphery—termed *peripheral arterial disease (PAD)* or *peripheral occlusive arterial disease (POAD)*.<sup>2</sup> Within this article both *PAD* and *POAD* are used interchangeably and refer to an occlusion or stenosis of the arteries located somewhere between the aorta and ankle.

The use of the ABPI in wound care practice has increased dramatically over the past 10 years.<sup>3,4</sup> Performing an ABPI test is commonly recommended practice as part of the assessment of people with chronic venous insufficiency and/or venous leg ulcers (VLUs). The ABPI has not only been recommended as a diagnostic test for PAD but also as a way to identify individuals at risk of



adverse effects caused by compression therapy, and to predict those with venous leg ulcers who are more likely to heal. This paper will discuss the research behind each of these three common uses of an ABPI in wound care practice.

### **ABPI as a Diagnostic Test for PAD**

The ABPI was designed for the purpose of detecting or diagnosing people with PAD. A diagnostic test that detects the presence of PAD is needed in clinical practice because PAD occurs commonly in the general population (12–14%)<sup>3</sup> and increases in prevalence with age.<sup>4,5</sup> Importantly, the majority of people with PAD are asymptomatic, with less than half of people with PAD experiencing leg pain and only 10% reporting intermittent claudication (calf muscle cramps when walking). In other words, if tests for intermittent claudication alone were used to diagnose PAD, it would miss 90% of patients. In fact, many individual clinical symptoms associated with artery stenosis or occlusion (such as pulses, and trophic changes in skin, including temperature, texture and colour) are not considered valid screening tools.<sup>6</sup>

Furthermore, there is a strong association

between damage or clogging of peripheral vessels and problems with other parts of the cardiovascular tree, including coronary arteries. It has been estimated that 68% of people with PAD also have significant heart disease.<sup>7</sup> Both men and women with an ABPI < 0.9 were twice as likely to have a heart attack or cardiovascular event.<sup>8,9</sup> In addition, a link between low ABPI values and a three-year mortality rate has been established.<sup>9</sup>

In 2016, the American College of Cardiologists and American Heart Association (ACC/AHA) guidelines for management of lower extremity PAD strongly recommended the use of ABPI to identify people at risk of future life-threatening cardiovascular events.<sup>10</sup>

### **ABPI Validation: Concurrent Criterion Validity**

To validate a new diagnostic test, researchers compare values derived concurrently from the “new” test to the results produced by a “gold standard” test or criterion measure. A good diagnostic test should be able to detect the presence or absence of the disease as defined by the gold standard. Research that validates a diagnostic test



should involve study participants who typically have the condition—i.e. elderly men and women with risk factors for PAD, including hypertension and hypercholesterolemia. They should include in the study sample population a similar number of people with and without the disease. Researchers should be qualified to perform the diagnostic test, and be blinded to the results of the other tests. Each study subject should undergo the new test *and* the gold standard test in random order with an appropriate time in between—not too short a time (such that the initial test might influence the results of the subsequent test) and not too long a time (such that other changes could occur and therefore similar test results are no longer expected).

When the new test finds the disease is present (test positive) and this agrees with the results of the gold standard test, this is considered a *true positive*. However, if the new test indicates the disease is present but the gold standard test does not, this is considered a *false positive*.

When the new test does not detect the presence of disease (negative) and this result agrees with the gold standard test, this is considered a *true negative*. However, if the new test does not pick up that the disease even though the disease is detected by the gold standard test, this is a *false negative* (see definitions on page 13).

Using these comparisons, values for sensitivity and specificity are calculated. *Test sensitivity* is the ability of a test to correctly identify those with the disease, whereas *test specificity* is the ability of the test to correctly identify those without the disease. More in-depth statistical analysis tests can also be performed, such as positive and negative likelihood ratios, but that is beyond the scope of this introductory paper.

The new test is considered acceptable when both sensitivity and specificity are near 1.0. This suggests that the new test is interchangeable with the former gold standard test. A good diagnostic test should have high values for *both* sensitivity and specificity, since the combination assures clinicians the test is able to detect when disease is present or confirm their patient is free from disease, or “normal.” High false negative results suggest the test is not sensitive. Clinicians using such a test cannot be sure their patient is free from disease. Conversely, a test with a high false positive may cause clinicians to incorrectly assume that their patient has the condition.

In 2008, a group of researchers from China evaluated 298 individuals (199 men, 99 women) who underwent an ABPI and angiography.<sup>11</sup> ABPI values of < 0.95 exhibited excellent agreement with digital subtraction angiography in detecting hemodynamically significant stenosis in the large vessels of the lower extremity. Sensitivity and specificity were both found to be high, at 0.91 and 0.86 respectively, suggesting the ABPI is a good non-invasive alternative to conventional angiography. Allen and colleagues compared the results of ABPIs to duplex ultrasound (US) scans of peripheral vessels (gold standard) and found the agreement depended on the cutoff value used for the ABPI, with a low ABPI (less than 0.6) at 100% agreement whereas higher ABPI values (0.9) have only 83% agreement between ABPI and US duplex.<sup>12</sup> Therefore, the more severe the PAD, the more likely the ABPI test will detect it. Other investigators have also reported high sensitivity and specificity (> 90%) when ABPI was determined using an ultrasound Doppler<sup>13</sup>—hence the endorsement of ABPIs by the AHA/ACC as a good non-invasive portable test for PAD.<sup>10</sup>

## Definitions

**Sensitivity:** probability of the test correctly identifying people who actually have disease

**Specificity:** probability of the test correctly identifying people who DO NOT have disease

**True Positive:** Results of the screening (new) test agree with gold standard test that the patient actually has the disease.

**True Negative:** Results of the screening (new) test agree with gold standard test that the patient DOES NOT have the disease.

**False Negative:** New diagnostic test indicates that the disease is not present, but the gold standard test indicates the disease is present—new test does not agree with gold standard.

**False Positive:** New test indicates that the patient does NOT have the disease, but the gold standard test found the disease is present—new test does not agree with gold standard.

## Example

One hundred patients undergo digital subtraction angiography or ultrasound duplex scan and 50 are found to have arterial obstruction or stenosis (by default that means the other 50 patients do not have PAD). When the same patients had an ABPI performed in the field, 55 of the total 100 had ABPI values below 0.95 (positive test), of which 45 also had positive angiograms/duplex scans.

		Peripheral Arterial Disease (PAD)	
		PAD Present (+)	PAD Absent (-)
NEW SCREENING TEST (ABPI)	ABPI < 0.95 (low) Positive Test	45 TRUE POSITIVE	10 FALSE POSITIVE
	ABPI = 0.95–1.2 (normal) Negative Test	5 FALSE NEGATIVE	40 TRUE NEGATIVE

## Calculations

$$\text{SENSITIVITY} = \frac{\text{TRUE POSITIVE}}{\text{TRUE POSITIVE} + \text{FALSE NEGATIVE (all patients with PAD)}} = \frac{45}{45 + 5} = 0.90$$

$$\text{SPECIFICITY} = \frac{\text{TRUE NEGATIVE}}{\text{TRUE NEGATIVE} + \text{FALSE POSITIVE (all patients without PAD)}} = \frac{40}{40 + 10} = 0.80$$

Unfortunately, a recent Cochrane review concluded that evidence about the accuracy of ABPIs for the diagnosis of PAD is sparse.<sup>14</sup>

### ABPI Validation: Reliability

Intra- and inter-rater reliability is the extent to

which the same rater, or two different raters, can obtain a similar rating on subsequent testing with the same instrument, when no change has occurred. Coefficients of agreement can be calculated, with values closer to 1.0 indicating good agreement between raters (see [Research 101: Wound Assessment Tools](#) for a full description of



test reliability).<sup>15</sup> Reliability or reproducibility of values generated by ABPI tests have been shown to be excellent (coefficient = 0.77 to 1.0) when evaluated by trained personnel.<sup>16</sup> Less than 10% variation has been reported between different observers, including family doctors and nurses.<sup>17</sup> Bonham and colleagues compared ABPI values generated by trained nurses and found over 85% agreement with laboratory values produced by a registered vascular technician.<sup>18</sup>

### ABPI Technical Limitations

As with all tests, the ABPI has its limitations. It is important that clinicians performing an ABPI are aware of the technical limitations—involving procedures and operator skills—as well as how to interpret findings cautiously and appropriately.<sup>19</sup> When a practitioner is learning how to conduct an ABPI test, time and effort should be dedicated to not only refining the skills needed to find and recognize Doppler sounds in leg vessels, but also to understanding the conditions that can alter ABPI values.

The following technical factors are known to affect the ABPI values:

- Room temperature too low, making the patient cold
- Insufficient length of rest period prior to test
- Patient not lying completely flat (supine)
- Extended time between taking arm and ankle measures
- Rapid deflation of the cuff, causing clinician to miss the maximum pressure when blood flow sounds return after inflation
- Probe moving off target vessel or away from the conductive gel
- Repeat inflations of the cuff
- Pain caused by over-inflation of the cuff or placement of the cuff over the calf muscle or other sensitive area (wound)
- Use of an inappropriate cuff size

Correct patient positioning and preparation of the test area is an important first step toward accurate and consistent ABPI values. To eliminate the added pressure exerted on leg vessels by gravity, patients need to lie completely flat (supine) for at least 15 minutes, so the level of the heart is the same for both the arm and ankle. The more extensive the person's cardiovascular disease, the longer it will take to equalize

Increased blood flow  
generates a  
natural healing response

geko™  
wound therapy

# Wound Therapy

Providing increased blood circulation to promote  
wound healing naturally from the inside



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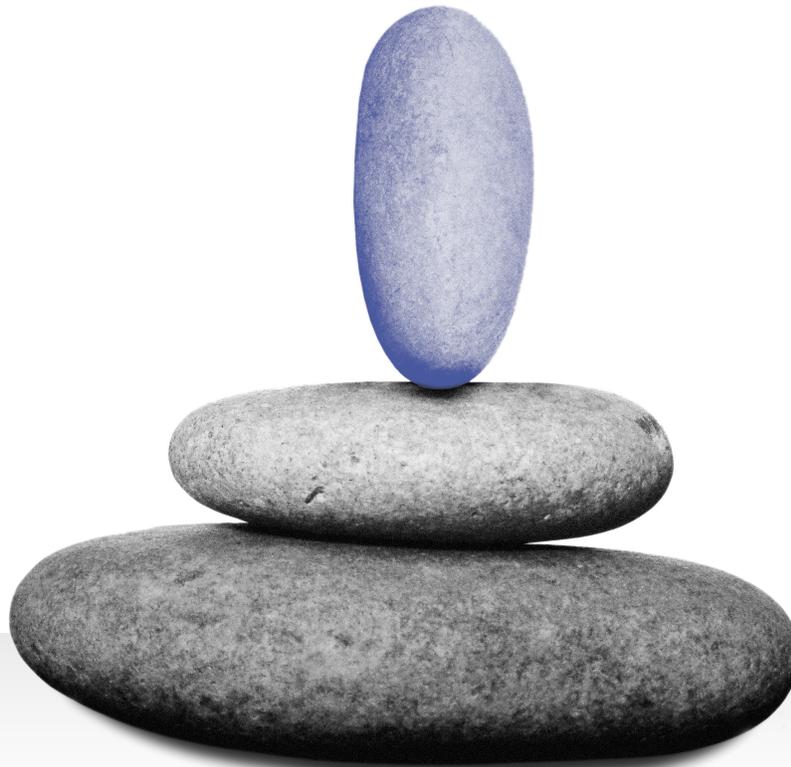
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1. Tucker AT et al. Int J Angiol. 2010 Spring;19 (1): e31-e37
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pressure across all parts of the cardiovascular system. As long as 25 minutes of complete rest in a supine position may be needed to normalize the peripheral arteries of people with PAD.<sup>1</sup> Note that people with chronic obstructive pulmonary disease (COPD) can become short of breath when lying with their head at the same level as their heart. It is known that systolic blood pressures vary by 3% or more with respiration; therefore, unless you use a machine that can simultaneously inflate both arm and leg cuffs, some variation in measured pressures is to be expected. Other large variations in ABPI values can result from technical problems related to positioning of the probe, causing the operator to lose the Doppler sound, or changes to the rate or amount of cuff inflation. Clinicians must use enough gel that the duplex US probe remains immersed in conductive medium throughout the test, and the probe can be placed on the skin without excessive pressure that can collapse the target artery.

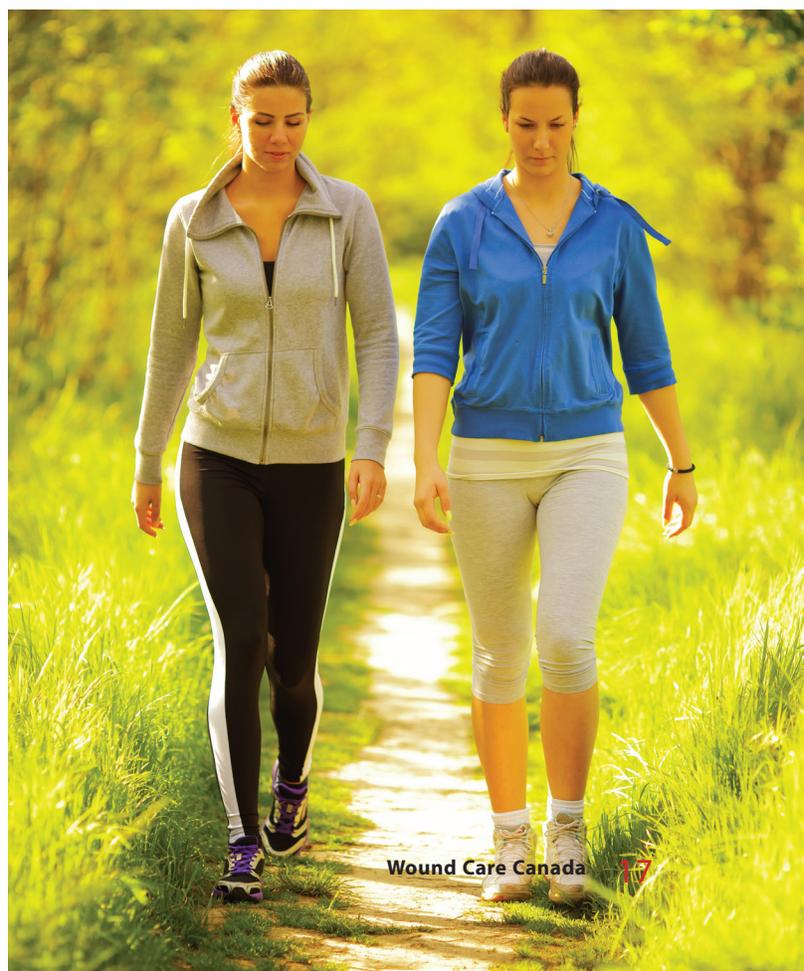
Clinicians performing ABPI tests not only need to practise the skills associated with using the portable US Doppler and cuff, but they should also understand how certain characteristics and co-existing health conditions can influence systolic pressures and ABPI values. The following clinical conditions will alter ABPI values regardless of how careful and precise the operator is:

- Conditions that cause vessel calcification
  - Diabetes
  - Renal failure requiring dialysis
- Anatomical differences in peripheral vasculature
  - Absent dorsal pedal artery
  - Arterio-venous anastomoses
  - Rich collateral network
- Low systemic blood pressure (hypotension)
- Respiratory distress when lying flat for prolonged periods (e.g., COPD)
- Conditions that cause peripheral vasoconstriction
  - Anxiety, stress (e.g., white-coat phenomenon)
  - Pain
  - Recent nicotine use (e.g., patient is a smoker, or involved in nicotine replacement therapies)

With longstanding or severe arterial disease, the

walls of arteries stiffen, and calcium is deposited into the walls of larger arteries. Calcification of large vessels is particularly common in people who have concomitant diabetes and/or kidney disease requiring dialysis.<sup>1,19</sup> With stiffer and calcified vessel walls, the pressure cuff must exert greater external pressure to obstruct blood flow, and this falsely elevates ankle systolic pressure. In 5 to 10% of cases, vessel calcification will be so extensive it prevents the pressure cuff from closing the vessel (noncompressible), and therefore ankle systolic pressure cannot be measured. Any condition that causes vessel walls to become stiffer can cause ABPI values to be falsely elevated and yield a high rate of false negatives. This will cause clinicians to miss PAD in individuals where arterial occlusion or stenosis is present.

Other conditions and medications known to affect the accuracy of ABPI values are those causing low blood pressure.<sup>1</sup> Lower arm systolic pressure can lead to falsely elevated ABPI values and a greater chance of missing underlying peripheral vessel disease. Last, any condition that changes peripheral vasoconstriction can alter ABPI values. These include factors such as patient anxiety or





stress, fever or cold, as well as chemicals known to alter arteriole vasoconstriction such as smoking or smoking cessation medications containing nicotine.

### ABPI and Compression Therapy

Though there is research evidence supporting the use of an ABPI in detecting PAD in high-risk individuals, the link between ABPIs and the selection of compression therapies is less well established. Vowden and Vowden, in a 2001 review article, describe how the ABPI became “the holy grail of leg ulcer assessment.”<sup>20</sup> The review authors say Cornwall was the first to suggest the use of ABPI via portable Dopplers to assess people with venous leg ulcers.<sup>20</sup> Cornwall suggested that “ulcers occurring in a limb of someone with ABPI < 0.9 should be considered ischemic, and those with ABPI < 0.75 had significant impact on clinical management.”<sup>21</sup> Callam and colleagues were the first to document a case of skin necrosis and amputation in a patient receiving compression therapy, and the authors urged the clinical community to “reduce compression levels in patients with ABPI < 0.7.”<sup>22</sup> This was followed shortly by another article published in *The Lancet*, documenting a large clinical trial of compression therapy involving participants who had venous leg

ulcers but excluding individuals who had an ABPI < 0.8.<sup>23</sup> And so was born the ABPI < 0.8 cut-off for using “high-compression therapy.” The anecdotal basis of this common clinical practice has led many reviewers to point out that a study has never been conducted showing lower compression is safe for people with ABPI < 0.8. This controversy brings to mind an article published in *The British Medical Journal* that poked fun at research processes used in systematic reviews. After an extensive literature search the authors concluded there was no randomized controlled trial available to support the use of parachutes by skydivers,<sup>24</sup> illustrating that direct research showing an intervention is safe is, in fact, neither feasible nor ethical.

While there is no direct evidence to link low ABPI values to compression-related complications, there is plenty of indirect evidence to suggest that judicious use of compression therapy on people with mild to moderate PAD (ABPI 0.8 – 0.5) can be beneficial,<sup>25–27</sup> and that adverse reactions when compression is used are rare and minor in nature.<sup>28</sup> Furthermore, in rare instances where tissue necrosis was reported after removal of compression bandages, it was not possible to determine whether necrosis was caused by underlying PAD or by poor bandaging technique. Additionally, increases in regional arterial blood flow have been measured in the presence of compression<sup>29</sup> and compression therapy has been applied without incident to patients with critical limb ischemia.<sup>25</sup> However, only the most experienced clinicians, who can monitor their patients daily, should use compression in this way.

The European Wound Management Association published a key article on this topic where they reviewed current guidelines related to compression therapy and ABPIs.<sup>30</sup> They conducted a systematic review of published and grey literature between 2009 and 2016 to find relevant guidelines, consensus documents, clinical pathways and practice algorithms that addressed risk factors, adverse events and complications when applying compression therapy to people with venous disease or venous ulcers. They found a total of 20 relevant articles, including 14 guidelines, three con-

sensus and position papers and three algorithms. Interestingly, none of these guidelines originated in Canada, including the RNAO (Registered Nurses' Association of Ontario) best practice guideline related to venous leg ulcer management.<sup>31</sup> They noted that all of the articles listed an ABPI  $\leq 0.5$  as an "absolute contraindication" for compression therapy, stating it should be avoided because of risk of serious complication. All guidelines recommended completing an ABPI in those people with venous leg ulcers, chronic edema and/or chronic venous insufficiency.<sup>30</sup> What was less consistent across international guidelines was what to do if ABPI values are between 0.5 and 0.8, which they termed a relative contraindication. In reality, there are many different materials and approaches to compression systems available, and sub-bandage pressures are known to change depending on whether the patient is lying down or standing and increase substantially when the calf muscle contracts during walking and other ankle movements.

Not surprisingly, most guidelines conclude more research is needed and that complications of compression therapy can almost always be prevented if clinicians perform a comprehensive assessment and are skilled in applying the compression system or bandages. This conclusion is consistent with many other review articles that caution against using a single ABPI cut-off point to drive clinical decisions.<sup>1,19</sup> Matching a safe and effective compression system to the patient requires advanced skill and professional judgment. Involving knowledgeable personnel in the provision of advanced therapies, like compression, is known to produce superior clinical outcomes (more venous leg ulcers healed) and be more cost effective.<sup>32</sup> ABPI tests should be one of a number of clinical observations used to evaluate the status of a patient's peripheral circulation. As with all medical devices, there are both risks and benefits of the intervention, and these must be weighed by a trained and well-informed health-care professional. What is most important is that the patient receiving compression therapy be provided with clear instructions, so they know what to expect and under what circumstances the com-

pression system or bandage should be removed.

Compression and other methods of treating chronic edema is a well-recognized best practice for the treatment of venous leg ulcers. However, recent surveys have shown as few as 11% of people with leg ulcers were receiving compression therapy.<sup>32</sup> Therefore organizations that require an ABPI be completed by a skilled clinician prior to providing compression therapy must ensure sufficient resources and qualified personnel are in place to prevent undue delays to this mainstay treatment of venous leg ulcers.

## Predicting Healing with ABPI Values

The final clinical application of ABPI values is as a predictive tool to determine the likelihood that a patient with a VLU will heal. Specifically, it is believed that people who have VLUs and have low ABPIs will not heal. Several studies have examined the relationship between ABPI values and the occurrence of non-healing and found that only at very low values of ABPI ( $< 0.6$ ) is there an association between ABPI values and wound healing rates.<sup>33,34</sup> In fact, other factors, such as how long the ulcer is present or compliance with compression, more strongly predict who will heal or achieve complete wound closure.<sup>33</sup>

## Clinical Implications

- ABPI is a portable vascular test recommended for use in the field by trained health-care professionals who can produce reliable and accurate assessments of systolic pressure of major arteries located in the arm and ankle region.
- Low ABPI values (less than 1.0) are known to detect PAD and agree well with more invasive vascular tests, including angiography and US duplex scans.
- People with a low ABPI should be referred to vascular specialists, since this can be a sign of significant and potentially life-threatening cardiovascular disease.
- Most international guidelines recommend performing an ABPI in people at risk of PAD, including those with chronic venous insufficiency and/or venous leg ulcers.

- If ABPI values indicate PAD is severe (ABPI 0.4–0.6), compression therapy is generally not recommended (absolute contraindication). What to do when patients have a VLU and ABPI values between 0.9 and 0.6 is less clear.
- It is difficult to predict based on an ABPI value who will and will not heal, especially for intermediate ABPI values between 0.6 and 0.9.

## Conclusions

ABPI was first developed as a diagnostic test able to detect PAD in people with significant stenosis of large leg arteries. However, its use in wound care practice has expanded in recent years since it is recommended that the ABPI can be used to screen people appropriate for compression therapy and to predict whether people with a VLU will heal. Available research suggests that only very low ABPI values indicating severe PAD should be used when deciding on compression and a patient's healability.

While more research is needed, there is universal agreement that management of people with edema, open wounds and leg pain is complex and requires health providers who are well informed and able to make advanced clinical decisions based on each patient's physical and emotional needs and preferences. 🏠

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## HOW TO ASSESS BLOOD FLOWING USING AN

# Ankle-Brachial Pressure Index (ABPI) Assessment

Developed by Wounds Canada Institute Faculty

When a patient presents with lower leg problems, such as pain, edema, an ulcer or other skin breakdown, one of the first tasks is to identify what the cause or causes might be, and which factors could affect treatment strategies. After taking a thorough patient history, a clinician should consider an ankle-brachial pressure index (ABPI, or ABI) assessment, a common test to determine any impairment to the arterial blood flow to the lower extremities. An ABPI assesses the ratio of systolic blood flow in the brachial artery to that of the dorsal pedis and posterior tibia. This article discusses how to conduct an ABPI.

### Equipment Needed

- Blood pressure (BP) cuff: cuff bladder length should be approximately 80% of the circumference of the upper arm, with the width approximately 40% of the circumference of the upper arm
- Doppler (preferred) with an 8 MHz vascular probe
- Ultrasound gel
- Towels for removing gel

### Steps

#### Step 1

1. Explain the procedure.
2. Ensure the patient has not smoked a cigarette within 24 hours of the procedure.
3. Have the patient roll up their sleeves and pant legs and remove shoes and socks.
4. Have the patient lie comfortably flat for a minimum of 15 minutes to normalize blood pressure and decrease patient anxiety.

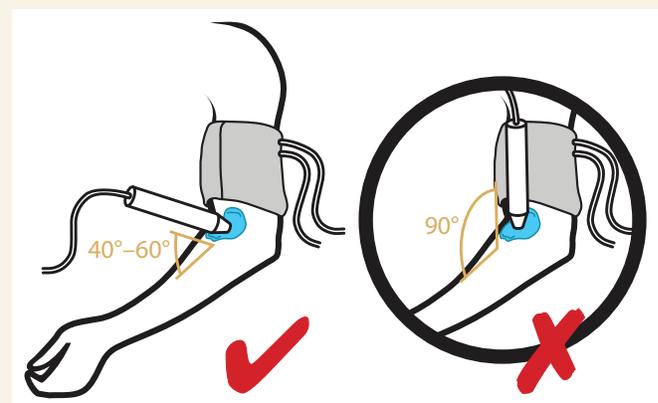
#### Step 2

1. Secure the appropriate size of blood pressure cuff around the arm, loose enough for two fingers but not so loose that it slips down. Pediatric or oversized cuffs may be required.
2. Locate the brachial pulse with your fingers in the patient's antecubital fossa.

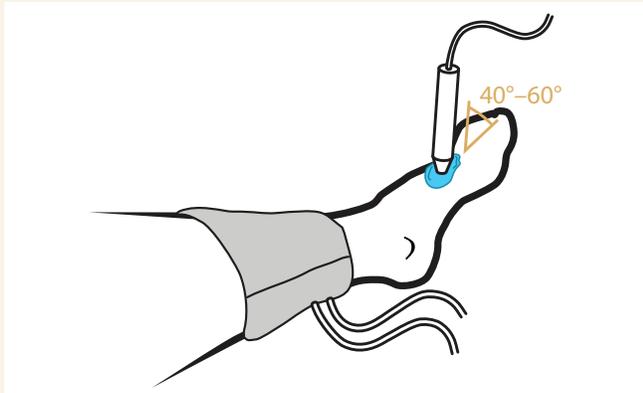
### Why Do an ABPI?

- ✓ To help to identify if arterial disease is a factor that is impacting leg health and wound healing
- ✓ To assist with goal setting and help guide treatment and referrals
- ✓ To protect against patient harm and clinician liability. For example, compression therapy cannot be initiated unless adequate blood flow has been demonstrated and documented (see Table 1).
- ✓ To help to stratify the degree of peripheral arterial disease

3. Apply a generous amount of ultrasound gel over the brachial pulse.
4. Slowly adjust the probe to obtain an audible signal (40- to 60-degree angle in the direction of the flow).
5. Inflate the cuff until the Doppler signal disappears, usually 20 mmHg above their normal BP, then gradually release the pressure valve until the signal returns.
6. Repeat on the other arm. (Brachial systolic pressure must always be assessed bilaterally.)
7. If you need to repeat the measure, wait one to three minutes before repeating the procedure.



**Figure 1:** Correct and incorrect angles for conducting an ABPI. In a successful assessment, the higher number of the two arms is the brachial systolic pressure (B).



**Figure 2:** Proper position and probe angle for measuring ankle systolic pressure (A).

### Step 3

Locate with your fingers the dorsalis pedis and posterior tibial pulses.

### Step 4

1. Secure the blood pressure cuff just above the ankle, making sure it is loose enough to insert two fingers between the cuff and the calf.
2. Locate the posterior tibial, dorsalis pedis and digital artery pulse using the Doppler probe and a generous amount of gel. Move the probe with

## Ankle Brachial Pressure Index

$$ABPI = \frac{A}{B}$$

where **A = ANKLE systolic pressure**, measured in the dorsal pedal artery, posterior tibial artery and digital artery (measure all three and calculate an ABPI for each)

and **B = BRACHIAL (ARM) systolic pressure**, measured in the left or right brachial artery (measure both and use the highest value found)

Calculate an ABPI for each ankle artery found using the systolic pressure from that artery. The clinician should expect the ankle and brachial pressures to be similar, yielding a ratio near 1.0.

## Common Problems

If you have difficulty with this procedure, do the following:

- ✓ Make sure you are using enough gel.
- ✓ Check that the Doppler probe is pointed toward the direction of blood flow (see figures 1 and 2).
- ✓ Check that the angle of the Doppler probe is between 40° and 60° (see figures 1 and 2).
- ✓ Check that the BP cuff is the correct size.
- ✓ Be patient. Slow down and take a breath.
- ✓ If necessary, ask for help from someone more experienced.
- ✓ If you find it hard to hear, use a headset to block out environmental noise.

- a 45- to 60-degree angle facing toward the heart until you get the loudest pulse sound. Listen carefully to the Doppler sound for each pulse and attempt to identify the waveform as triphasic, biphasic or monophasic (you may require headphones to block out environmental noise).
3. Inflate the cuff until the Doppler signal disappears, then gradually release the pressure valve until the signal returns. Repeat with the second and third pulse.

### Step 5

To calculate the ABPI, divide the appropriate ankle systolic pressure by the highest brachial systolic pressure (ABPI = A/B). Record the ABPI for each artery tested.

## Tips

- ✓ Prepare your equipment before beginning the procedure.
- ✓ In some elderly patients, the dorsalis pedis pulse is difficult to find. Move down the dorsum of the foot along the first ray and look between the first and second digit.
- ✓ Remember that an ABPI is only one parameter of testing. Results should be considered in relation to presented symptoms and risks, such as claudication and critical ischemia.

**Table 1:** Interpreting the ABPI

Value	Interpretation	Clinical Correlation
> 1.40	Interpret with caution; may indicate calcified vessels	<ul style="list-style-type: none"> <li>• Be aware of possible falsely elevated measures.</li> </ul>
1.0 – 1.40	Normal arterial flow	<ul style="list-style-type: none"> <li>• Pulses palpable and no signs of arterial disease</li> </ul>
0.91 – 0.99	Borderline arterial flow	<ul style="list-style-type: none"> <li>• Pulses palpable and no signs of arterial disease</li> </ul>
0.70 – 0.90	Mild impairment of arterial flow	<ul style="list-style-type: none"> <li>• Often have no symptoms and no clinical signs of arterial disease</li> </ul>
0.41 – 0.69	Moderate impairment of arterial flow	<ul style="list-style-type: none"> <li>• Abnormal exam</li> <li>• May give history of claudication pain</li> </ul>
< 0.40	Severe impairment of arterial flow (critical limb ischemia)	<ul style="list-style-type: none"> <li>• Abnormal exam</li> <li>• May give history of rest pain</li> </ul>

### Step 6

Discuss the results of this test and their implications with your patient. Interpretation of the value of the ABPI is shown in Table 1.

### When to Conduct a Toe-Brachial Pressure Index (TBPI)

Incompressibility can occur if calcification of arteries is present. This is indicated by an abnormally high ankle systolic pressure. If there is concern about calcification of vessels, especially in the presence of diabetes, the toe-brachial pressure index (TBPI) can be obtained in a similar fashion using a toe-pressure cuff around the first digit. The Doppler is then used to obtain a systolic reading from the plantar aspect of the first digit. If there is a first-toe amputation, any digit can be used if the appropriate digit-sized cuff is used.



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## WCI Spotlight

# Focus on the Prevention and Management of Venous Leg Ulcers: Knowledge and Skills (A105MWS)

**D**eveloped and delivered by national experts in skin health and wound care, Focus on the Prevention and Management of Venous Leg Ulcers: Knowledge and Skills is one of the most

popular programs in the current Wounds Canada Institute line-up.

Consisting of two online modules, one full-day on-site skills lab and an interactive webinar (completed in the order listed), this program is based on

the concepts contained within the upcoming Best Practice Recommendations for the Prevention and Management of Venous Leg Ulcers. The program allows students, under the guidance of expert faculty, to learn about and practise skills relevant to the prevention, assessment and management of venous leg ulcers. Practical skills include conducting an ankle-brachial pressure index, using a monofilament, conducting mobility and gait assessments, demonstrating calf-muscle pump exercises, and choosing and applying compression bandages and garments. The wrap-up webinar invites students to discuss with faculty the challenges they have faced and strategies they have used in implementing the knowledge and skills learned into their everyday practice.

### Here's what some respondents found most useful about the program:

"I found everything very helpful. I enjoyed the opportunity and would recommend it to anyone." —Christine, an acute-care registered practical nurse (RPN) from Meaford, Ontario

"Hands-on practical skills application, under supervision, with opportunity to ask questions and advice from faculty." —Sandra, a community care RPN from St. Thomas, Ontario

"Assessments, better application of multidisciplinary roles and interventions. Enhanced understanding of holistic approach to care planning." —Barbara, a long-term care home RPN from Wiarton, Ontario



Aimed at nurses and allied health-care professionals who self-identify as novice or advanced-beginner related to the prevention, assessment and management of venous leg ulcers, this program finds many students practising at a competent level (relevant to the subject matter) and prepares them to seek out mentorship opportunities in their respective workplaces, where they can perfect their skills over time and strive towards proficiency.

Evaluation of our most recently completed A105MWS program, attended by 38 health-care professionals, revealed that 100% of respondents felt that there was “moderate to significant improvement in

their knowledge when comparing their pre- and post-tests.” All respondents also indicated that they “Were somewhat or extremely confident in their knowledge and skills relating to the prevention and management of venous leg ulcers after completing the program.”

### **Upcoming Skills Lab in Halifax in April**

The Skills Lab for Venous Leg Ulcers, part of the Focus on the Prevention and Management of Venous Leg Ulcers: Knowledge and Skills program, will be offered in Halifax, Nova Scotia, prior to the 2019 Wounds Canada spring conference. Join our expert faculty on April 11

to practise your skills. Follow Barbara’s advice: “Do it. Well organized and great focus on theory prior to the skills lab makes for a better skills lab experience.”

For more information on the upcoming skills lab in Halifax, click [here](#).

### **Further Information on WCI Programs**

For more about the Focus on the Prevention and Management of Venous Leg Ulcers: Knowledge and Skills program and other Wounds Canada Institute (WCI) programs, visit the WCI institute website at: [www.woundscanadainstitute.ca](http://www.woundscanadainstitute.ca). 

# A Home Care Practice Change in Compression Wrapping

By Shannon Bowman, RN MN IIWCC, and Sarah Brown, BSc RN MN IIWCC

## The Problem

After the Winnipeg Regional Health Authority (WRHA) Home Care program held numerous wound care consults for lower leg ulcers in the home setting throughout Winnipeg, it was discovered that nurses were changing disposable, short-stretch compression bandages three or more times a week, regardless of the amount of wound exudate and despite the fact compression bandages can be left on for up to a week. The program conducted a needs assessment by examining how nurses currently determine when to change compression bandages. The rationale provided by many community nurses for changing the compression wraps three or more times a week was "That's how we've always done it." They also stated the belief that compression bandages cannot be left on for more than three days.

These responses emphasized a knowledge gap among the nurses. As a result, WRHA completed an analysis of the data on compression wrapping frequency throughout the 12 community areas within Winnipeg. In the period August to October 2016, pre-intervention results were as follows:<sup>1</sup>

- On average, 42 out of 142 patients received wrapping three or more times/week (30% of the

total wound care patients receive compression wrapping three or more times/week).

- On average, the number of hours/week for wrapping three or more times totals 111 hours.
- On average, the total number of visits/week for wrapping three or more times is 156.
- \$5,550/week of nursing time is spent on wrapping three or more times/week.
- \$288,600/year of nursing service time is spent on compression wrapping three or more times/week.
- \$103,671/year is spent on disposable, short-stretch compression wrapping for one leg three or more times/week (see Table 1).

The WRHA Home Care Program provides approximately one million nursing visits to 9,500 clients annually. More than 40% of the clients receive nursing services for wound care.<sup>1</sup> Venous leg ulcers account for 40% to 70% of chronic lower extremity wounds, and, in the absence of any significant arterial disease, compression therapy in the form of bandaging is the cornerstone of ulcer management.<sup>2</sup> Thirty percent of the total wound care clients in the WRHA area receive compression wrapping three or more times a week for the management of venous leg ulcers or



mixed (venous and arterial) ulcers with adequate arterial perfusion.<sup>1</sup> The cost of each nursing visit is approximately \$50, and the annual cost to WRHA Home Care of compression wrapping three or more times a week is \$288,600.<sup>1</sup> Clients with venous and mixed disease represent a significant and costly concern to the health-care system, which was evident in the annual cost of compression wrapping in Home Care.

### **The Aim of the Practice Change**

The goal was to implement a wound care best practice change based on the indications for compression wrapping (e.g., amount of exudate and/or slippage) to avoid nurses routinely changing dressings three or more times per week. Another aim was to reduce WRHA Home Care's supply cost for disposable, short-stretch compression bandages by \$20,000 in 2017/2018.

### **Literature Review and Methods**

WRHA completed a literature review on best practices for lower leg ulcers, formed an improvement team, which included the director, members from the Home Care senior leadership team, CNSs, and Nurse Educators (NEs), and shared results from

the literature. The team established measures to determine what evidence would show that a change was an improvement. Outcome indicators of compression wrapping in WRHA Home Care were as follows:<sup>1</sup>

- Reduction in the frequency of compression wrapping
- Percentage reduction in the frequency of compression wrapping

*A practice change in compression wrapping may be useful for any Home Care program wishing to improve the management of lower leg ulcers and reduce the annual cost of compression wrapping.*

- Reduction in the cost associated with nursing visits
- Reduction in the total number of visits spent on wrapping
- Decrease in weekly cost associated with nursing visits
- Decrease in annual costs associated with nursing visits

- Decrease in annual cost associated with disposable, short-stretch bandages

Many of the community nurses expressed that they did not have a good understanding of the indications for the various types of compression bandaging systems. Expert wrappers also voiced concerns that the novice wrappers were not providing a constant level of tension to the bandages, resulting in boggy spots in various areas. Tinker, Hoy and Martin<sup>3</sup> and Welsh<sup>4</sup> articulate that clinicians' knowledge and skill in the techniques of compression bandaging can directly influence patient outcomes (i.e. wound healing) and their quality of life. Poor bandaging techniques can lead to pain, tissue damage (especially to areas of bony prominences, which include the malleoli, medial and lateral aspects of the foot, and the Achilles tendon) and even necrosis.<sup>5</sup>

After recognizing that there were significant gaps in community nurses' understanding of the indications for use of disposable and reusable



short- and long-stretch compression bandaging systems, when to change compression bandages, deficits in compression bandaging techniques, and the cost of compression wrapping to WRHA Home Care, the team developed an educational program that was delivered to each of the 12 community areas throughout Winnipeg.

During this time of economic change, the Manitoba Provincial

Government had requested all Regional Health Authorities find opportunities to reduce spending, thereby helping to decrease the overall provincial deficit. WRHA Home Care identified the need to reduce the cost of disposable, short-stretch compression bandaging systems and submitted a WRHA Deficit Reduction Proposal Analysis to reduce the supply cost of disposable, short-stretch bandages in 2017/2018 by \$20,000.

Home Care implemented the following multifaceted interventions to promote this wound care best practice change:

## Key Lessons Learned

Allow more time for nurses to perfect compression wrapping techniques.	Feedback on evaluation forms indicated that more time would have been beneficial to practise various bandaging techniques. In the future, education sessions may be arranged to provide community nurses with another opportunity to practise and improve their wrapping techniques.
Include the patient's perspective.	There was no involvement with the patient's perspective. We may consider a patient survey about their experiences with compression wrapping, wound outcomes, ambulation and impact on quality of life.
Audit wound care charts.	It would be beneficial to complete a wound care chart audit on WRHA Home Care patients with lower leg ulcers that are in compression to assess wound outcomes, healing and pain. Results could then be used to further improve wound care quality and outcomes.
Reconsider location of education sessions.	Nurses expressed challenges with finding parking when attending the downtown education sessions. We will try to schedule future education sessions where parking is free and readily available.

**Table 1:** Compression Wrapping Evaluation and Outcomes in Home Care

Outcome Indicators	Pre-Interventions (August – October 2016)	Post-Interventions (April – July 2018)	Percentage Change
Average number of patients that receive compression wrapping 3 or more times/week	42	30	↓ 29%
% of total wound care patients receiving compression that are wrapping 3 or more times/week	30% (42/142)	19% (30/154)	↓ 37%
Average total hours of service/week spent on wrapping 3 or more times/week	111	77	↓ 31%
Average total number of visits/week for wrapping 3 or more times/week	156	109	↓ 30%
Cost/week of nursing time spent on wrapping 3 or more times/week	\$5,500	\$3,800	↓ 31%
Cost/year of nursing service time spent on compression wrapping 3 or more times/week	\$288,600	\$200,304	(↓31%) = \$88,296
Cost/year of disposable, short-stretch compression system wrapping for one leg 3 or more times/week	\$103,671	\$72,437	(↓ 30%) = \$31,234 (Actual savings)

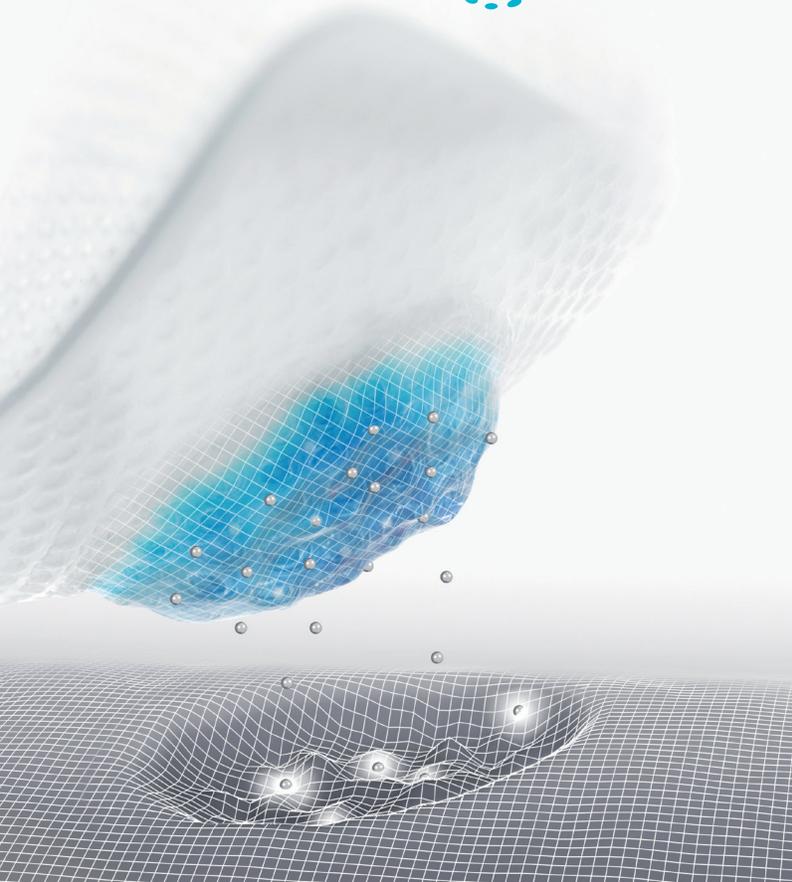
- Compression wrapping education sessions: CNSs and NEs delivered educational sessions to 12 community areas in Winnipeg. These sessions featured a theory component on the various types of compression wraps and safe ergonomics in wrapping, and included some practice wrapping.
- Compression bandaging tip sheet: Educational material was provided to the community nurses about when to initiate compression, when compression is contraindicated and when to change compression bandages. Tip sheets also included data on the frequency and cost of compression wrapping in the community.<sup>1</sup>
- Clinician enabler: A practice tool was developed to help nurses determine whether active or passive compression should be selected and to review the various types of compression bandages available.
- Patient care review meetings: CNSs attended meetings in each community area identified as having a high frequency of compression wrapping. This allowed the CNSs to actively listen to the assessment of the client's wound(s), the current wound management and the frequency

of dressing changes. The CNSs then made suggestions for individual patients on how wound exudate or slippage might be better managed and, if clinically appropriate, decreased the frequency of compression bandage changes to once or twice a week.

## Results

Post-interventions outcome indicator data were collected at three different intervals; however, for the purpose of this paper, the April to July 2018 time frame will be compared to the pre-intervention outcome indicator data from August to October 2016 (see Table 1). For the period April to July 2018, Home Care patients saw a reduction in the following:

- Frequency of compression wrapping by 29%
- Percentage of total wound care patients receiving compression wrapping by 37%
- Average total hours of service per week spent on wrapping by 31%
- Average total number of visits per week by 30%
- Cost per week of nursing time spent on wrapping by 31%



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- Cost per year of nursing service time spent on compression wrapping by 31%

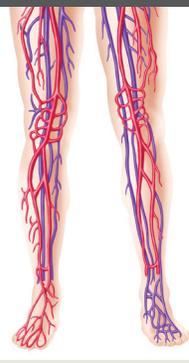
These results add up to \$88,296 in savings of nursing service time, and a 30% saving in cost per year of disposable short-stretch compression wrapping for one leg, for an actual savings of \$31,234.<sup>1</sup>

### Conclusion

Overall there was a significant reduction in the average number of Home Care patients who received compression wrapping three or more times/week since completing multifaceted interventions. There was also a reduction in the average total hours and average total number of visits per week. Most notable were the verbal reports from nurses about how numerous patients' venous leg ulcers had healed after they were switched from a short-stretch to a long-stretch compression system. Other areas of savings to the WRHA Home Care were a reduction in the weekly cost of nursing time spent on compression wrapping and a reduction in the supply cost of disposable, short-stretch compression systems. In summary, a practice change in compression wrapping may be useful for any Home Care program wishing to improve the management of lower leg ulcers and reduce the annual cost of compression wrapping. 🏠

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# Symposium Series

2019 SYMPOSIUM SERIES

# New Perspectives in Diabetic Limb Preservation

Wounds Canada is pleased to announce our new Symposium Series and our first program: **New Perspectives in Diabetic Limb Preservation**

**What:** This is a one-day learning event that will include sessions on the medical management of persons with diabetic foot ulcers, vascular considerations, infection, wound management, offloading, the challenges of renal patients and more. Delegates of the symposium will have the opportunity to meet with over 30 key opinion leaders from across Canada and listen to presentations from national and international experts in the field.

**When:** Friday, May 31, 2019

**Where:** DoubleTree by Hilton, Downtown Toronto, 108 Chestnut Street, Toronto ON

**Who:** This event is aimed at health-care providers from a number of disciplines with an interest in this topic and/or who are working with patients with lower limb complications that can lead to amputation, including all types of primary care professionals and specialists such as surgeons, family physicians, pharmacists, nurse practitioners, chiropodists and surgical podiatrists. This event will also be of interest to health-care policymakers.

Included in the agenda:

- Value of Limb Preservation Clinics
- Vascular Topics
- Infection – Diagnosis and Management
- Emerging trends in all topics

Visit [here](#) to see the most up-to-date agenda.

*This event is the first of its kind and is a joint venture between Wounds Canada and the Canadian Podiatric Medical Association and is endorsed by the Division of Vascular Surgery at the University of Toronto and Canadian Vascular Society. This program meets the certification criteria of the College of Family Physicians of Canada and has been certified by Continuing Professional Development, Faculty of Medicine, and the University of Toronto for up to 7 Mainpro+ credits.*

## Register now!

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# The Power of Protein in Wound Healing

By Ellen Mackay, MSc RD CDE



**G**ood nutrition provides the raw ingredients to help wounds heal and preserve skin integrity. Every step in the wound healing cascade requires good nutrition, especially protein. Many of our patients come to us malnourished due to illness, pain, poor appetites or inadequate intake over the years. Timely and adequate nutrition support not only helps in wound care but also improves overall nutrition status and may help lower health-care costs.<sup>1</sup>

## The Role of Protein

Protein is a macronutrient with many key roles in wound healing. It is vital in the synthesis of enzymes and the creation of collagen, connective tissue,

capillaries and epithelial cells. Amino acids provide the building blocks of antibodies, macrophages and a healthy immune system. A lack of protein may prolong the inflammatory stage of wound healing, impair adequate collagen synthesis leading to reduced tensile strength of a closed wound and increase the risk of a wound becoming chronic.<sup>2</sup>

## How much is enough?

Protein requirements depend on several factors. Current nutrition status, size and number of wounds, other concurrent health conditions such as renal disease and cardiac status should be taken into account in assessing an individual's protein requirement. Unfortunately, assessing protein status can be a chal-

lenge, as there are few valid hematological markers that accurately define malnutrition. (See Wounds Canada's Best Practices Recommendations for The Prevention and Management of Pressure Injuries, 2018, for a list of screening tests that may help identify nutritional barriers to wound healing.<sup>3</sup>)

The average healthy Canadian needs approximately 0.8 grams of protein per kilogram of body weight.<sup>4</sup> This translates into about 64 grams of protein for an 80-kilogram man or about 55 grams for a 68-kilogram woman. When wounds are present, protein requirements are significantly greater. The most well-reviewed guidelines for protein requirements in wound care come from the nutrition



support of those with pressure injuries. A white paper published by the National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance suggests patients at risk of a pressure injury or with existing pressure injuries need 1.2 to 1.5 grams of protein per kilogram body weight daily.<sup>5</sup> This translates to 96 to 120 grams for an 80-kilogram man or 82 to 102 grams for a 68-kilogram woman. Some patients may need up to 2 grams per kilogram body weight, especially those with heavily exudating wounds. Other advisory panels suggest similar requirements.<sup>6</sup> Eating enough protein may make the difference between a wound stalling or making efficient progress through the

wound-healing cascade.

Larger protein intakes may be contraindicated in individuals with impaired renal function. In addition, as protein intake increases, fluid requirements increase; be sure to provide additional fluids to those with higher needs. (See [Healing with Hydration](#) for suggestions to help keep your patients well hydrated.<sup>7</sup>) Consult a registered dietitian to provide a comprehensive nutrition assessment and help patients meet their protein and nutrition needs.

### What About Arginine?

Recently there has been growing interest in the role of two specific amino acids, arginine and glutamine, in accelerating wound repair.<sup>9</sup> Our bodies naturally produce arginine and

glutamine, but in times of stress, such as with a wound or sepsis, the body's demand for these amino acids outweighs supply, and these amino acids become conditionally essential and must be provided through the diet.

Arginine is receiving much attention as it plays an important role in wound repair, stimulating insulin secretion, promoting the transport of amino acids into tissue cells and supporting the synthesis of protein and collagen in the cells. Perhaps more important, arginine is a precursor to nitric oxide, a powerful neurotransmitter that helps blood vessels relax and dilate, improving blood flow to the wound bed. For these reasons, research is underway to determine if supplementation with arginine may indeed enhance

wound repair, or if increasing overall protein intake is sufficient to heal wounds.<sup>10</sup>

### The Importance of Calories

Wound healing is an anabolic event. Calories from carbohydrates and fat are needed to “spare” the protein, to allow the protein to do its job in wound healing and preserving skin integrity. Without adequate calories, protein is broken down and used for energy. It has been suggested that patients would benefit from 30 to 35 kcal/kg body weight daily for adults with a wound or at risk for developing a wound, such as pressure injuries.<sup>6</sup> To increase calorie intake, offer nutrient-dense foods, fortified



foods and/or high-calorie supplements with or between meals. It can be helpful to liberalize a patient’s diet restrictions to help improve overall calorie intake. Enlist a dietitian to assist with maximizing your patient’s intake.

### Protein-Rich Foods

Foods rich in protein include animal proteins such as meat, poultry, eggs, fish and seafood. Other

good sources include milk products such as milk, kefir, cheese and yogurt. Animal proteins provide all the essential amino acids. Plant proteins such as legumes (beans, peas and lentils), tofu, nuts and seeds are also good sources of protein and provide valuable fibre. Our vegetarian or vegan patients can meet their protein requirements with plant

sources and by paying attention to variety in their intake. See Table 1 for the protein content of common foods. Encouraging patients to eat protein-rich foods at each meal and snack will assist them in meeting their higher dietary protein targets and result in healthy wound healing. See the sidebar below for ideas to increase protein intake.

## Maximizing Protein Intake<sup>8</sup>

### Milk Products

- Cook hot cereals in cow’s or soy milk.
- Top fruit or cereals with Greek-style yogurt.
- Grate cheese onto vegetables; add cheese to sandwiches; eat cheese with crackers at snacks.
- Add skim milk powder to fluid milks.
- Top fruit salad with cottage cheese.
- Choose milk-based soups instead of broths.
- Drink milk or soy milk at meals instead of water.

### Meat and Alternatives

- Add tuna to salads or eat with crackers.
- Mix ground meat into soups, stews or casseroles.
- Eat hard-boiled eggs for snacks or in salads.
- Top salads with chickpeas and black beans; mix legumes into soups; include tofu in stir fries.
- Include hummus in sandwiches or as a dip.
- Top toast with scrambled eggs; make French toast instead of plain bread.
- Enjoy a bowl of baked beans as a snack.
- Add seeds and nuts to baked goods, hot cereal, yogurt or rice dishes.

Getting patients to meet their protein needs through food may be a challenge. Occasionally those with wounds may experience poor appetite due to pain, depression or illness. Including protein through supplemental protein powders (e.g., whey, soy, hemp, rice or pea protein) and oral liquid nutrition supplements may help bridge the gap until patients are well enough to consume appropriate amounts.

For more information on protein-rich foods explore the Dietitians of Canada's website [Unlock Food](#) to learn more.

## Conclusion

Good nutrition has the potential to support effective wound closure, create stronger skin integrity and reduce patient burden and health-care costs.

Clinicians should pay attention to a patient's nutrition needs and make nutrition support a priority to encourage wound healing. 🍴

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**Table 1:** Protein Content of Common Foods<sup>11</sup>

Food	Serving	Protein (g) (approximate)
Meat, fish, poultry	75 g (2.5 oz) or 125 mL (1/2 cup)	21
Cottage cheese	125 mL (1/2 cup)	13
Yogurt, Greek style	175 mL (3/4 cup)	14
Eggs	2 large	12
Tofu	150 g or 175 mL (3/4 cup)	12
Cheese	50 g (1.5 oz)	12
Dried beans, peas and lentils, cooked	175 mL (3/4 cup)	12
Cow's milk	250 mL (1 cup)	9
Yogurt	175 mL (3/4 cup)	7
Fortified soy beverage	250 mL (1 cup)	7–8
Peanut butter or other nut/seed spreads	30 mL (2 tbsp)	4
Nuts or seeds	60 mL (1/4 cup)	3–8

# Wound Care Certification of Nurses in Canada: How to Obtain Credentials and Employer Recognition

By Crystal McCallum, RN MCISc

**A**s the education manager at Wounds Canada, each month I receive at least one email from an enthusiastic Canadian nurse asking how they can become “certified” in wound care. Unlike in the United States, where wound care certification programs are plentiful, in Canada, for nurses, the Canadian Nurses Association (CNA) is the only nationally recognized nursing specialty credentialing body. The CNA Certification Program offers 22 practice specialties for registered nurses and one for licensed/registered practical nurses. Specific to wound care, registered nurses can obtain a Wound Ostomy Continence Certificate (Canada) by successfully completing a rigorous exam. If successful, registered nurses can incorporate the specialty designation WOCC(C) into their professional signature—a legally protected credential that is renewable every five years. (For more information, visit the CNA website: [www.cna-aiic.ca](http://www.cna-aiic.ca).)

## Obtaining Recognition from Employers

While only CNA can issue “certification,” nurses can obtain recognition from employers by

registering for programs from organizations and institutions who have a track record for providing excellence in wound education. The following are a few of these options:

- The Wound, Ostomy and Continence Education Program (WOC-EP), an educational program of Nurses Specialized in Wound, Ostomy and Continence Canada (NSWOCC), is a combined online and practical program that takes approximately 12 months to complete. Available to baccalaureate-prepared registered nurses only, this tri-specialty program prepares registered nurses to practise at a proficient level in the field of wound, ostomy and continence care. Upon successful completion of the program, registered nurses can add the NSWOC designation to their professional signature. As a natural extension, NSWOCC suggests that graduates proceed to writing the CNA exam to obtain the legally protected title of WOCC(C). For more information, visit the NSWOCC website: [www.nswoc.ca](http://www.nswoc.ca).
- The Dalla Lana School of Public Health at the University of Toronto offers a “professional” master’s program in advanced wound care. This degree program (MScCH WPC) consists of five credits that can be completed in one year full-



time or over six years on a part-time basis. The program is described as a professional master's because it can be completed by health professionals who are working full-time. It is open to health professionals with an interest in wound care who have an undergraduate degree from a recognized university. Further information about the program and entrance requirements can be found at [www.dlsph.utoronto.ca/program/mscch-wound-prevention-and-care-wpc/](http://www.dlsph.utoronto.ca/program/mscch-wound-prevention-and-care-wpc/).

- Master of Clinical Science (MCISc) in Wound Healing program is a unique full-time graduate degree program at Western University in London, Ontario. This accredited program, which takes 12 months to complete, consists of academic, clinical specialty and research courses and is primarily completed using distance education methods, with six weeks of mandatory residency on campus. Those who achieve an overall average of 70%, complete 100 hours of clinical mentorship and pass a final clinical exam may use the designation MCISc-WH in their professional signature. Anyone proficient in English and with a bachelor's degree from a recognized university and at least a B standing in the final two years of their undergraduate program can apply for this program, which prepares registered health-care professionals of any discipline to practise at a proficient to expert level, depending on the expertise and experience the

student has when admitted to the program. For more information, visit the Western University website: [www.uwo.ca](http://www.uwo.ca).

- The International Interdisciplinary Wound Care Course (IIWCC) is a continuing education program that provides students with a certificate of completion from the University of Toronto. This online course (with two four-day residency periods), which takes nine to 12 months to complete, is open to registered health-care professionals of any discipline with proof of five years of relevant wound care experience. For more information, visit the Woundpedia website: [www.woundpedia.com](http://www.woundpedia.com).
- Several colleges also offer continuing education programs in wound care of various lengths, from one day to one week. Programs vary in content and delivery methods and may or may not have a formal evaluation. Most programs are aimed at health-care professionals with a novice to advanced-beginner level of wound care knowledge and skill. Certificates range from attendance to participation to successful completion, each having a different value and meaning.
- The Wounds Canada Institute (WCI) offers a variety of cost-effective educational programs for health-care professionals of all disciplines. The current focus is to meet the educational needs of those who self-identify as at a novice to advanced



level relative to their skin health and wound management knowledge and skills. Programs combine online modules (courses) ± on-site skills labs ± live interactive webinars. Successful students receive a certificate of completion. For more information, visit the Wounds Canada Institute website: [www.woundscanadainstitute.ca](http://www.woundscanadainstitute.ca).

- Wounds Canada offers a selection of stand-alone live events for which students receive a certificate of attendance. For more information, visit the Wounds Canada website: [www.woundscanada.ca](http://www.woundscanada.ca).

## Recommended Path to Becoming “Certified”

If you are a registered nurse in Canada, my advice is to follow these steps, in the order listed, to become “certified” in wound care:

1. Successfully complete the following Wounds Canada Institute programs, which provide a solid foundation for wound prevention and management in a range of areas:
  - a. Best Practice Approach to Skin Health and Wound Management: Knowledge (A100MNN)
  - b. Best Practice Approach to Skin Health and Wound Management: Knowledge and Skills (A100NWS)
  - c. Focus on the Prevention and Management of Pressure Injuries: Knowledge (A102MWN)
  - d. Focus on the Prevention and Management of Surgical Wounds Complications: Knowledge (A103MWN)
  - e. Focus on the Prevention and Management of Skin Tears: Knowledge (A104MWN)
  - f. Focus on the Prevention and Management of Venous Leg Ulcers: Knowledge and Skills (A105MWS)
  - g. Focus on the Prevention and Management of Diabetic Foot Ulcers: Knowledge and Skills (A101MWS) **OR** Holistic Approach to Diabetic Foot Offloading: Knowledge and Skills (A108MWS)
2. Seek out mentorship opportunities within your workplace to enhance your knowledge and decision-making abilities and to become competent in your wound related knowledge and skills.
3. Successfully complete the WOC-EP program.
4. Successfully complete the CNA Wound, Ostomy and Continence Certification exam.
5. Seek out mentorship opportunities within and outside your workplace to become proficient in your wound related knowledge, decision-making abilities and skills.
6. Successfully complete the MCISc-WH graduate degree program at Western University, the MScCH WPC program at the University of Toronto and/or the IIWCC program at the University of Toronto to progress towards becoming an expert in the field of wound healing.

Continue to seek out new learning opportunities to keep your practice current. Consider becoming a mentor and getting involved in wound care research. 🇨🇦

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## Wounds Canada Education:

The Wounds Canada line-up for 2019 so far covers a range of topics and formats, allowing individuals to choose the program that best suits their current learning needs.

Live events begin in April and run throughout the year.

### **April 12–13, Halifax, NS: 2019 Wounds Canada Spring Conference**

A two-day continuing education event designed to support health-care professionals from a variety of disciplines who work with patients with wounds or those who are at risk for developing wounds, with sessions delivered by regional, national and international experts.

### **April 13, Halifax, NS: Wound Care for Primary Care Practitioners**

An interactive half-day event that builds on the content of select Wounds Canada Best Practice Recommendation documents. Case studies and discussions will address differential diagnoses and common misdiagnoses as well as strategies for prevention and management for a variety of wound types.

### **May 31, Toronto, ON: Symposium Series: New Perspectives in Diabetic Limb Preservation**

A one-day learning event that will include sessions on the medical management of patients with diabetic foot ulcers, vascular considerations, infection, wound management, offloading, the challenges of renal patients and more, delivered by national and international experts.

### **October 3–6, Niagara Falls, ON: 2019 Wounds Canada Fall Conference**

Canada's largest wound-related event; four days of sessions, networking opportunities, poster presentations and access to industry partners for health professionals from a variety of disciplines.

### **Coming soon: Wound Care for Primary Care Practitioners Online**

An online version of our popular Wound Care for Primary Care Practitioners, allowing busy professionals to access the modules anytime from anywhere. Stay tuned for launch date.

Details about these and other programs are listed on the Wounds Canada and Wounds Canada Institute websites, and new programs are added regularly. Check in often for updates.



# Charcot Foot: An Overview

By Robyn Evans, BSc MD CCFP FCFP and Mariam Botros, DCh DE

## Case Presentation: Red, Hot Foot

Mr. R.T. is a 63-year-old who presents to his local walk-in clinic with a warm, red, swollen right foot. He had noticed for the previous couple of days that it was becoming more difficult to get his work boots on. He says it is not painful.

His past medical history is significant for type 2 diabetes for 14 years. He has hypertension. He is a non-smoker and drinks 12 beers per week. He does not test his blood sugars. His body mass index (BMI) is 28.

Medications include: metformin 1g bid, ramipril 10 mg qd, rosuvastatin 10 mg qd. He takes these prescriptions as indicated.

He works in a factory and wears steel-toed boots. His job requires a lot of walking.

The attending physician examines the right foot and notes:

- Pulses bounding at the right dorsalis pedis and posterior tibial
- No skin breakdown; specifically, web spaces are clear
- Right foot is swollen and warm to touch
- Homan's sign (the dorsiflexion sign) is negative
- No palpable tenderness anywhere in the right foot or calf
- Nail changes consistent with a fungal infection
- Patient's temperature: 37° C; heart rate: 76 beats per minute; BP: 136/87 mmHg
- Monofilament score 10 negatives/10 bilaterally
- Left foot shows no swelling or redness

Mr. R.T. is sent home with a prescription for cephalexin for 10 days and instructions to follow up with his own family doctor. Blood work is ordered to check complete blood count (CBC), C-reactive protein (CRP), uric acid, creatinine, blood sugar and HbA1c.

Four weeks later Mr. R.T. presents to his own family doctor concerned that his foot has a different shape at the arch and that there is a small open area.



## Avoiding a Devastating Misdiagnosis

The scenario in this case study is not an unusual presentation or management for a red, swollen foot. However, the diagnosis of infection was incorrect, as the patient, in fact, had Charcot neuroarthropathy (CN). Charcot neuroarthropathy is often misdiagnosed.<sup>1</sup> The most common misdiagnoses for an acute CN are listed in Table 1: Differentiating infection/osteomyelitis from CN can be a particular challenge. This article outlines the basics of CN and highlights the need for a high index of suspicion when a patient with diabetes presents with a hot, swollen foot.

**Table 1:** Common Misdiagnoses of Acute Charcot Foot<sup>2</sup>

Infection	Inflammatory	Other
<ul style="list-style-type: none"> <li>• Cellulitis</li> <li>• Osteomyelitis</li> <li>• Septic arthritis</li> </ul>	<ul style="list-style-type: none"> <li>• Acute arthritis</li> <li>• Gout</li> <li>• Pseudogout</li> </ul>	<ul style="list-style-type: none"> <li>• Deep vein thrombosis</li> <li>• Sprain/Strain</li> <li>• Fracture</li> </ul>

## What is Charcot neuroarthropathy?

Charcot neuroarthropathy (CN), also known as Charcot foot, is a rare inflammatory disease involving the musculoskeletal system of the foot and ankle.<sup>3-4</sup> The disease process ultimately results in deformity of the foot or ankle due to collapse, fracture and destruction of structures under significant pressure. Unfortunately, this can lead to increased risk of ulceration, amputation, use of financial resources for patient care, as

well as expense to the patient for ongoing accommodative footwear. The risk of amputation with CN is 15% but increases to 35 to 67% in patients with an associated ulcer.<sup>2</sup> This condition has been classified based on clinical and radiologic findings (see Table 2).

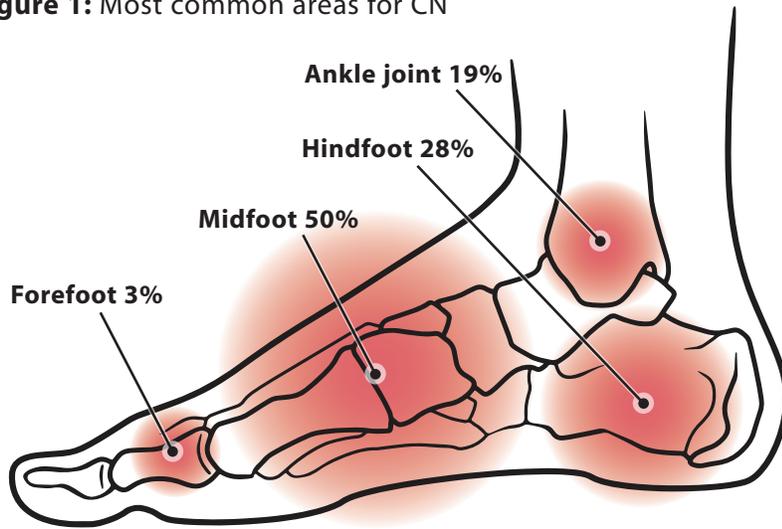
## The Pathophysiology of Charcot Neuroarthropathy

The pathophysiology of CN is not entirely known. In 1868 Jean-Martin Charcot was the first to

**Table 2:** Classification of Charcot Neuroarthropathy<sup>2,5-6</sup>

Eichenholtz Classification (plus Stage 0)	Description	Management
<b>Stage 0</b>	This is the beginning of the acute stage, characterized by erythema, edema and heat.  X-ray evidence may not be seen.	<ul style="list-style-type: none"> <li>• Immobilize (e.g., using a total contact cast [TCC], instant total contact cast [ITCC] or removable walking cast [RCW]).</li> <li>• Reduce weight-bearing activity.</li> <li>• Manage blood glucose levels.</li> </ul>
<b>Stage 1: Development</b>	The acute stage is characterized by erythema, edema and heat.  Bone resorption, bone fragmentation and joint dislocation may all be seen on X-ray.	<ul style="list-style-type: none"> <li>• Immobilize (TCC/ITCC/RCW).</li> <li>• Reduce weight-bearing activity.</li> <li>• Manage blood glucose levels.</li> </ul>
<b>Stage 2: Coalescence</b>	The subacute stage is characterized by decreasing warmth, edema and erythema, and by absorption of fine debris and fusion of large fragments and new periosteal bone formation on X-ray.	<ul style="list-style-type: none"> <li>• Use patellar tendon-bearing brace (PTB).</li> <li>• Use Charcot restraint orthotic walker (CROW walker).</li> <li>• Manage blood glucose levels.</li> </ul>
<b>Stage 3: Reconstruction</b>	The chronic stage is characterized by resolution of swelling and erythema. Consolidation of fractured bone and evidence of deformity may be seen on X-ray.	<ul style="list-style-type: none"> <li>• Use patellar tendon-bearing brace (PTB).</li> <li>• Use Charcot restraint orthotic walker (CROW walker).</li> <li>• Use custom-made shoes with or without a brace.</li> <li>• Manage blood glucose levels.</li> </ul>

**Figure 1:** Most common areas for CN



describe Charcot foot as a late sequela of tertiary syphilis,<sup>6</sup> but it was not described in diabetic patients until almost 70 years later.<sup>7</sup> The two basic theories of its etiology are neurotraumatic and neurovascular.<sup>3,8</sup> In the neurotraumatic theory, some form of trauma (acute, subacute or cumulative and repetitive) in the neuropathic foot initiates a cascade of inflammation. This then leads to intense osteoclastic activity and joint destruction. In the neurovascular theory, autonomic neuroarthropathy results in vasodilation and increased blood flow. This causes congestion in the venous system and ischemia to the ligaments and tendons, leading to joint instability. This increased blood

flow also increases osteoclastic activity. If the patient continues to walk and the process goes unchecked, it results in destruction of the susceptible joint of the ankle or foot. Although diabetes is the major cause, any patients with peripheral neuroarthropathy can develop CN. Epidemiologic studies have identified other risk factors for CN (see sidebar, this page).<sup>9</sup>

**What are the physical, historical and laboratory findings?**

The diagnosis of CN should be based on a careful history and clinical examination of the skin and the neurologic, vascular and musculoskeletal systems (see

Table 3). Though only a third of patients will report an inciting trauma, this cause should be considered.<sup>3</sup> Patient co-morbidities as well as gait and balance are important to consider when making management decisions. Unfortunately, 40% of patients will have an ulcer at the time of presentation with a Charcot foot.<sup>3</sup> If an ulcer is present, superimposed infection should be considered. Some patients have been treated for recurrent episodes of cellulitis with little response and no laboratory or systemic signs of infection. The most common

**Risk Factors Associated with CN**

- Peripheral neuroarthropathy
- Advanced age
- Male gender
- Caucasian
- Lower education level
- Increased body-mass index
- Decreased bone mineral density
- Pancreas and/or kidney transplant
- Elevated HbA1c
- Osteomyelitis
- Recent surgery

**Table 3:** Physical and Historical Features of CN<sup>2-3</sup>

Skin	Neurologic	Vascular	Musculoskeletal	Other
Varying amounts of swelling, erythema and warmth (3 – 5° C warmer than the contra-lateral, unaffected foot). Use infrared cutaneous temperature monitor. Ulceration may be present. Positive probe-to-bone test.	Sensory, motor and autonomic changes of diabetes. Test using the 10 g Semmes-Weinstein monofilament.	Pulses bounding in the foot.	Varies depending on the stage of CN. Early on, nothing will be seen. Later, joint deformity or instability will be present; classic “rocker bottom” deformity.	Complaint of pain in the foot.

## Indications of Possible Infection or Cellulitis

- Proximal streaking of erythema, which is not a feature of CN
- Presence of constitutional symptoms
- Decrease of dependent rubor if the affected limb is elevated for several minutes. If there is infection, this erythema will remain.
- Laboratory evaluation indicating significant elevation of erythrocyte sedimentation rate (ESR) and CRP, which may be consistent with infection. (Unfortunately, patients with diabetes often have a muted response to infection, so these values may not increase as expected.)
- Presence of an ulcer, skin breakdown or other portal of entry.
- Presence of an ulcer with a positive probe-to-bone test.

areas involved are the midfoot (50%) followed by the hindfoot (28%), the ankle joint (19%) and the forefoot (3%)<sup>6</sup> (see Figure 1 on facing page).

## Imaging Considerations

Radiographs are the recommended initial imaging study to be done. The characteristic bony changes of CN can take weeks to see on plain X-rays and therefore are not useful for diagnosing CN in the early stages—when clinical intervention is critical. It is helpful to take bilateral X-rays to pick up subtle changes in the bone.<sup>4</sup>

For patients with diabetes and an ulcer, X-rays should look for bony abnormalities, soft tissue gas or the possibility of a foreign body.<sup>10</sup> Table 3 lists the musculoskeletal changes that can be expected at each stage of CN. A venous duplex ultrasound scan should be considered if deep vein thrombosis is suspected. Magnetic resonance imaging is able to detect bone marrow changes, soft tissue edema and joint effusion early in the disease.<sup>8</sup> Nuclear imaging techniques may be used when MRI is not available or contraindicated.

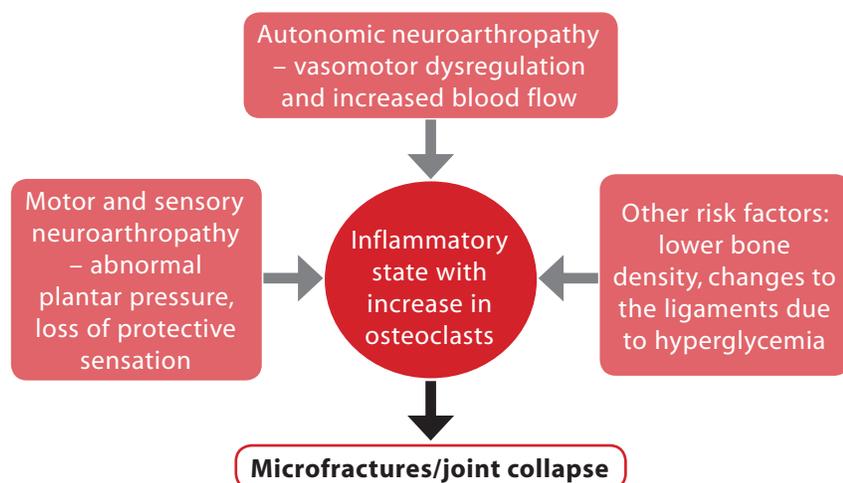
Eichenholtz classified Charcot foot based on radiological findings in three stages,<sup>11,12</sup> and later Shibata proposed an additional Stage 0, which is characterized by erythema, edema and heat without X-ray confirmation.<sup>11</sup> Patients at this stage are often misdiagnosed with cellulitis, gout or deep vein thrombosis due to lack of radiographic evidence.<sup>5</sup>

## Management

Management of Charcot foot is based on the acuteness of symptoms, anatomic location and degree of joint destruction.<sup>4</sup> If a clinician is initially unsure about the diagnosis, it is recommended that they treat the condition as Charcot neuroarthropathy by offloading until diagnosis is confirmed or disproven. Early detection and protection are key to preventing further destruction of the foot.

In the acute stage, immobilization and reduction of weight-bearing activities for eight to 12 weeks is the mainstay of treatment. The gold standard for immobilization of Charcot foot is a total contact cast (TCC),

**Figure 2:** Factors Leading to Microfractures or Joint Collapse



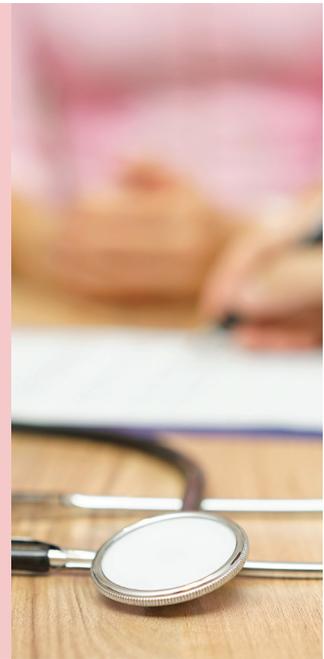
## Important Facts about CN/Diabetes

- Patients with peripheral vascular disease are somewhat protected from CN as vasodilation is part of the pathogenesis.<sup>3,8</sup>
- Joints are the weak link in the structure of the foot, and therefore more susceptible.
- The midfoot is most often affected as it is subjected to more force during the phases of walking. This is the classic “rocker bottom” deformity. However, any joint of the foot can be affected.<sup>9</sup>
- Hyperglycemia causes increased risk of ligament and tendon weakening.<sup>3,10</sup>
- Patients with diabetes often have lower bone mineral densities, a factor for development of CN. This is more of an issue with type 1 than type 2 diabetes.<sup>2</sup>
- Only a third of patients will report trauma leading to their symptoms.<sup>3</sup>



## An Alternative Scenario

The physician at the walk-in clinic was aware of a rare condition called Charcot foot. He was still concerned, however, that he would miss an infection in this patient with diabetes. He prescribed cephalexin but also advised the patient to remain non-weight bearing as if he had an acute fracture. He sent him home with an RCW, which was available in his pharmacy, instructions to stop working, and an urgent referral to a multidisciplinary clinic that deals with diabetic foot issues. The following day the blood report was obtained and indicated a normal CBC, creatinine, and CRP. His HbA1c was 9.6%.



but devices like a removable cast walker (RCW) are also commonly used to offload the foot. Continue immobilization until lower extremity edema and warmth resolve accompanied by evidence of fracture consolidation.<sup>2,6</sup>

In the subacute and chronic stages, recommend devices include the Charcot restraint orthotic walker (CROW) and the patellar tendon-bearing brace (PTB). In the chronic stage, custom-made shoes are indicated.<sup>2,6</sup>

Surgery may be considered if conservative treatment fails to establish a plantigrade foot.

There is currently no evidence for the use of bisphosphonates in managing CN.<sup>2,6</sup>

## Conclusion

Charcot neuroarthropathy is a commonly missed diagnosis. It relies on an astute clinician, because early physical findings can be subtle with little help from

imaging or laboratory. Early diagnosis is important for leading to early, appropriate management and prevention of further complications. CN should be suspected in any patient over 40 years old with peripheral neuropathy that presents with an acutely swollen foot with little or no known

## Key Points

- ✓ A high index of suspicion is required to correctly diagnosis CN in a timely manner.
- ✓ Develop an approach to the red, hot, swollen foot with or without pain. Consider the possibility of infection, which can co-exist with Charcot changes.
- ✓ If Charcot neuroarthropathy is a concern, advise the patient to remain non-weight bearing while appropriate referrals are arranged.

trauma. It is unclear why not all patients with diabetic neuroarthropathy develop Charcot foot. Inflammation seems to be at the core of the process, and this may be related to risk factors and genetic predisposition.<sup>13</sup>

It can be difficult for health-care providers on the front line to access the appropriate referrals in a timely manner. Enlist help from colleagues when referral to a multidisciplinary team is not possible. An orthopedist, podiatrist or chiropodist should be able to help with these difficult cases.

Consider CN in the differential diagnosis of a red, swollen foot to prevent the devastating consequence of a deformed foot and long-term effects on quality of life, morbidity and mortality. 🇺🇸

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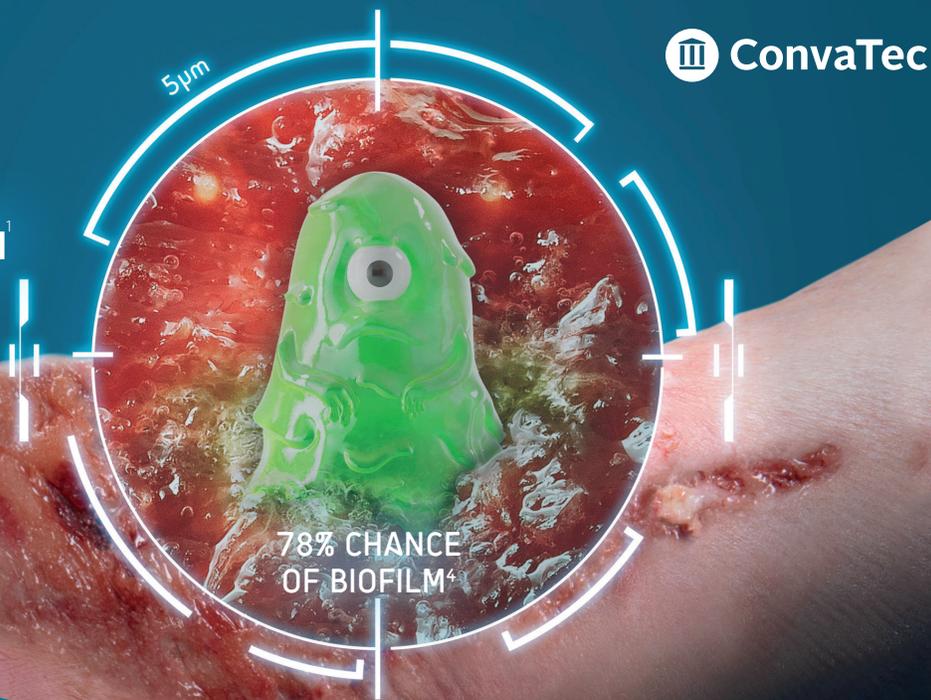
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# Kimberly Lacey, RN BN MCISc-WH

*In an interview conducted by Janet L. Kuhnke, RN BA BScN MS NS-WOC Doctorate in Psychology, on January 4, 2018, in Nova Scotia, Kimberly Lacey outlines her job as the Program Lead for the Nova Scotia Provincial Wound Prevention and Management Program and discusses the rewards and challenges her role brings.*



Kimberly Lacey



Janet L. Kuhnke

## **Q** Can you describe your background and current role in wound care?

**A** I have practised wound care since I began my nursing career. I began working in both surgical and chronic wound care when I was employed on the vascular and general surgery inpatient unit in Halifax. On this unit I cared for a high-risk population—those with peripheral arterial disease, various vascular diseases and, of course, diabetes.

The experience of working with surgical site infections, diabetic foot ulcers and vascular wounds generated my interest in wound prevention and management. I felt that I wanted to gain as much knowledge as I could. In my first year, I was given the opportunity to shadow the clinical nurse specialist in the multidisciplinary leg ulcer clinic (MDLUC) at Halifax Infirmery through a professional practice grant. This initiative was all about developing “wound champions” for our inpatient unit. It was an amazing experience that opened my eyes to the complexity of wound management. This is when my journey really began and I decided to continue my professional development and knowledge, first by completing the International Interprofessional Wound Care Course (IIWCC) at the University of Toronto in 2015, and then the Master of Clinical Sciences

of Wound Healing at the University of Western Ontario (UWO) in 2017. During my time in these programs, as well as various other courses relating to wound prevention and management, I completed a significant number of clinical hours and gained vast hands-on experience working with arterial, venous and complex diabetic foot ulcers, pressure injuries, as well as wounds associated with surgical site infections.

As I worked towards the completion of both these programs, I continued my work as a vascular nurse, and I completed many clinical practice hours in MDLUC. It was a satisfying opportunity to be able to support my nursing unit and other colleagues with the new skills and knowledge I had gained. My confidence to help mentor and build the capacity of other nurses and colleagues is something I take great pride in, as this is part of how we make lasting practice changes and encourage the leaders of tomorrow. I have benefited from having great mentors in my life and I want to be able to do for someone else what these mentors have done for me.

Currently, I am the Program Lead for the Nova Scotia Provincial Wound Prevention and Management Program along with my colleague, Eleanore Howard, RN MSN CETN(C). This is a new

provincial program that works collaboratively with the Department of Health and Wellness, and key stakeholders throughout the province, to standardize the delivery of evidence-based wound prevention and management practices across all sectors of our health-care system.

**Q How has your role in wound care and research evolved over the past year?**

**A** Over the past year my role in wound prevention and management has changed significantly. I believe that my completion of the master's degree at UWO, along with my clinical practice hours, have enhanced my confidence, knowledge and skills in the prevention and management of wounds with various etiologies. I have had the opportunity to network with interdisciplinary teams across Canada and to foster relationships with stakeholders in the Canadian wound care community.

This past year, I participated in a research study looking at the key practices that wound care clinicians should incorporate into care. This is still a work in progress. Most recently, I had the opportunity to be involved in a peer review of a number of research abstracts submitted for the national Wounds Canada conference. These opportunities and experiences have prepared me for my current position and for my role in developing an evidence-based wound prevention and management program in Nova Scotia.

**Q What is your view on interdisciplinary wound care teams?**

**A** In Nova Scotia, we are seeing the growing trend of patients living with type 2 diabetes. Current reports suggest that 11.4% of the Nova Scotia population has diabetes; this number will only continue to rise. These are patients with complex health-care needs that demand the efforts of interdisciplinary teams to ensure the highest level of comprehensive and evidence-informed care.

The impact that an interdisciplinary team can have on a patient is considerable. The current literature support for an interdisciplinary team approach in health care highlights the patient benefits and better clinical outcomes such as

shortened hospital times, reduced community-based care visits and better pain management. Working towards a common goal enables each team member to carry out their individual role while working collaboratively to ensure the patient is receiving optimal care for better outcomes. Working together to achieve common goals supports mutual respect for the skills and expertise that each member—including the patient—brings to the team.

I have had the opportunity to work within an interdisciplinary team in many different settings. With every interaction, I feel empowered by being a part of the team. Being able to collaborate with other health-care professionals has assisted in building my professional practice, as members of the team are constantly learning from one another.

**Q Could you describe what you see as critical success factors to developing an interdisciplinary wound care team?**

**A** The success of developing an effective interdisciplinary team is determined by sharing common goals and visions of the services that the team provides for each individual patient case. Collaborative efforts must be focused on achieving the objectives that have been decided upon by the collective group.

**Q What are some of the biggest challenges that you have seen in the practice of wound care? Do you see them as barriers or solutions?**

**A** One of the greatest challenges I have experienced in the practice of wound care is the knowledge gap that exists around what wound prevention and management really encompasses. Much too often, *wound care* is being used to refer to the dressing change, and not to all the tasks required for the prevention and management of wounds. Historically, wound care has been a nursing responsibility, and nurses often admit to having received varying and incomprehensive wound management education; a common theme among health professionals. Often, these clinicians are working in isolation; not as part of an integrated team. I see this not so much as a barrier but an opportunity to start a conversation—a conversa-

## Learn more about Nova Scotia's leadership in wound care at the Wounds Canada spring conference, April 12–13, in Halifax, NS!

Wounds Canada's spring conference, *We're All in This Together*, is a two-day continuing education event designed to support health-care professionals who work with patients with wounds or who are at risk for developing wounds. Join wound experts and your colleagues for these Nova Scotia-specific sessions:

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- A Snapshot of the Diabetic Foot in Nova Scotia
- Pressure Injuries in Nova Scotia: Prevalence and Prediction

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tion that can lead the way for practice change in this province. We have the opportunity to facilitate a paradigm shift in ideas and practices from wound care to wound prevention and management.

### **Q** What is the biggest challenge in wound care in your present role?

**A** Nova Scotia has experienced a major health care restructuring over the last three years, where there has been an amalgamation of nine health districts into one provincial health authority. Historically, communication and collaboration were practised within the individual districts; now, as one health-care authority, we have a great opportunity to build effective and sustainable processes throughout the province. Prior to the provincial amalgamation, clinicians operated with varying policy and protocols documents, including those specific to wound care.

Over the past several years some tremendous work has been done; individual initiatives have been carried out across the province that have demonstrated a strong desire to provide effective wound care. Clinicians will now be able to work together, uniting ideas, practices and passions, and engage with stakeholders across the province to create sustainable processes that will facilitate high-quality, evidence-based care that will translate to better patient outcomes.

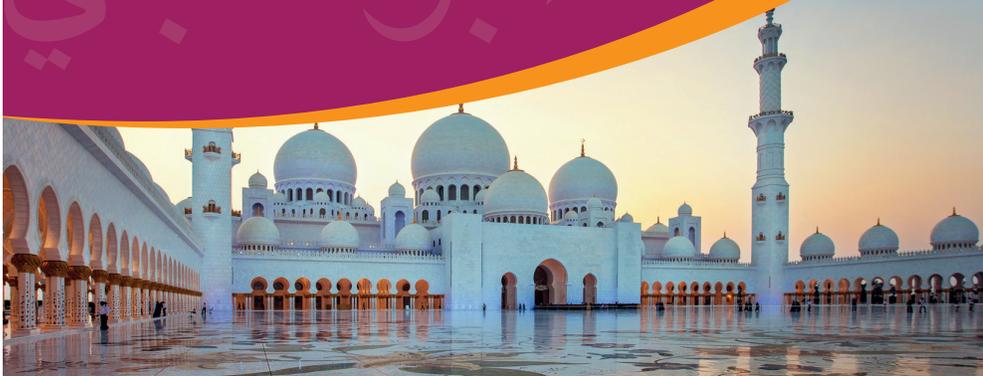
One example of a collaborative wound care initiative is the Pressure Injury Prevention Program, which has been successfully rolled out

across the entire Nova Scotia Health Authority (NSHA). As the structure of the health-care system in Nova Scotia has changed dramatically, there are many challenges and potential barriers that we will encounter on the road to establishing provincial process. However, we also have many strengths and advantages. We have a provincial health authority led by dedicated and passionate leaders who have a desire to work together to provide the best possible services, to draw expertise and experience from within and beyond, to practise innovative health care and to improve the quality of health care for all Nova Scotians.

### **Q** Any last comments?

**A** As NSHA moves forward as a united health-care system, health-care providers have an incredible opportunity to unite the province through strong, passionate and dedicated leadership. It is an absolute privilege to engage and collaborate with stakeholders in this province to develop a provincial, evidence-based wound prevention and management program that will facilitate better patient outcomes, and perhaps inspire fellow Canadians. I am so excited to have been given the opportunity to take part in this initiative, as well as to be part of the larger wound care community within Canada. I am very eager to see how together, in a truly collaborative spirit, we can impact the practice of wound prevention and management—not just in our province, but nationally as well. 🇳🇸

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# Wound Sleuth

By Katie Krause, MD FRCPC and Carol Ott, MD FRCPC

## Pressure Injury in the Older Adult

### The Patient

A 95-year-old female, with a left-sided meningioma leading to right-sided weakness and right lower limb paresis causing her to be bed-bound, was seen in a long-term care ward for what was assessed to be a stage 2 pressure injury in the sacral area (see Figure 1) that began 10 days prior. Due to general decline, and respiratory issues including aspiration pneumonia, she was

considered to be palliative and at end of life.

The wound was 4.0 x 2.0 cm in size, very superficial, and contained some exudate (see Figure 1). At the time of the assessment, she was using a foam pressure-relieving mattress and a wheelchair with an offloading cushion and fitted back. Her main complaint at the time of assessment was significant pain at the site of her wound both

while in the chair and in bed. Since there were some concerns that infection was causing her pain, a course of amoxicillin 875 mg/clavulanic acid 125 mg for two weeks was started. It was changed to ciprofloxacin 250 mg for two weeks once the culture came back growing *Pseudomonas*. Upon completion of her antibiotic therapy, the wound was smaller and drier than before, but the pain persisted.

**Q** What was the cause of the pain, and how would you treat it? What factors need to be considered when setting goals of care?

A referral to the palliative care team to help with pain and symptom relief came with a recommendation for the initiation of gabapentin and hydromorphone. Given the limited time that the patient's son and daughter felt they had with their mother, they were concerned about the side effects of confusion and drowsiness that accompanied adequate pain control.



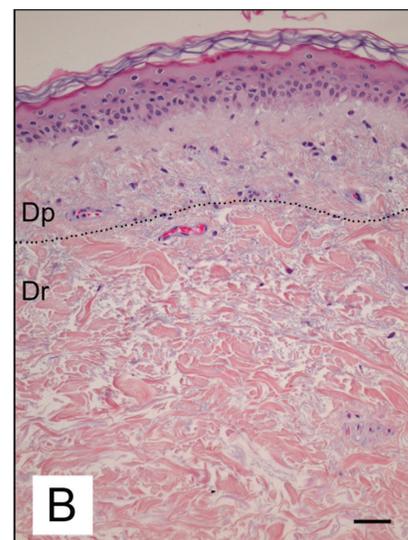
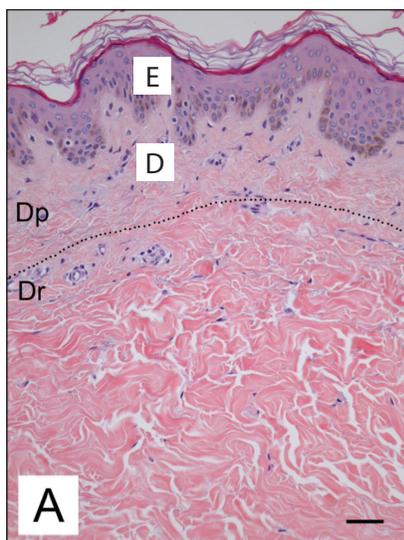
**Figure 1:** The Patient's Sacral Ulcer

Her wound was healing well on her current foam mattress; however, the pain did not abate. Her care team, including nurse, occupational therapist, primary care physician and geriatrician/wound care physician, discussed the use of an air-flow bed as a trial to see if it would help with pain in the sacral area. Once the bed was in place, the patient had a profound and virtually immediate improvement in pain. Clinicians were able to decrease the amount of hydro-morphone to 0.5 mg at supper-time and 1 mg at bedtime. This allowed her to be more awake and interactive with her family during the day. She continued to take acetaminophen throughout the day and pregabalin at bedtime.

## Treating the Patient and the Cause, Not Just the Wound

Pressure injuries can be very painful. Over time, aging skin loses integrity, with flattening of the epidermal-dermal junction and thinning of these layers (see Figure 2). The amount and length of mature elastic fibres within the dermis increases, and trans-epidermal water loss occurs that impacts the skin's ability to resist compressive forces.<sup>3,4</sup>

Skin contains more sensory nerves than any other organ in the human body.<sup>5</sup> These nerves are activated by acute trauma or sustained pressure, inflammation, damaged nerve endings, infection, shearing forces with dressing changes, debridement and other topical treatments.<sup>6</sup>



**Figure 2:** Histological Sections from Skin Biopsy of 19-year-old (A) and 74-year-old (B).

These photographs demonstrate flattening of the epidermal-dermal junction and thinning of these layers. E = epidermis, D = dermis, Dp = papillary dermis, Dr = reticular dermis.<sup>1,2</sup>

Ulceration and pressure injury can erode tissue planes, creating inflammation and irritated nociceptive nerve terminals. This occurs with mechanical, chemical or thermal insults to the skin. When new nerve terminals are regenerating, they send out signals that may cause heightened sensitivity to pain in the wound (primary hyperalgesia) and in the surrounding skin (secondary hyperalgesia).<sup>7</sup>

Damage to these nerves may cause a neuropathic-type pain, and attempts to control this type of pain involve tricyclic antidepressants such as nortriptyline and amitriptyline, serotonin-norepinephrine re-uptake inhibitors such as duloxetine and venlafaxine, or alpha2-delta ligands such as pregabalin and gabapentin.<sup>8</sup> Unfortunately, these medications can cause significant drowsiness in older adults, and their anti-cholinergic properties

can precipitate a delirium in more frail populations.

Other analgesics used in the treatment would be acetaminophen, non-steroidal anti-inflammatory drugs (NSAIDs), or opioids. Acetaminophen is a reasonable first-line choice as its side-effect profile in the elderly is minimal as long as liver function is intact. It may, unfortunately, not be adequate to control severe pain in this population. NSAID medications have more contraindications in older adults so therefore have a more limited role and should be used with caution. Opioids are often the chosen agent, but drowsiness can be a limiting side effect, as it was in this patient's case.

## The Importance of the Bed Choice

It can at times be difficult to access higher-end beds, so it

was important to involve the physician, occupational therapist and wound care nurses to advocate for the patient within the hospital setting to receive the alternating air-flow mattress. This type of mattress, until recently, was perceived as a treatment for those with stage 3 wounds or worse. The significant improvement in pain that occurred with a change in mattress argues for the use of this type of mattress as a pain-management therapy in itself and it should therefore be considered in any wound stage where pain is a significant complaint or issue.

## The Positive Outcome

In the case of this patient, we were pleased that the change in mattress resulted in such remarkable pain relief. Her family

reported that she was reasonably coherent and comfortable for her final days, which allowed them to spend quality time with her before her passing two months later.

Through a multi-disciplinary approach, we were able to find a solution to our patient's pain that had the fewest side effects, keeping in mind that the goal of patient care was comfort and quality time with her family. 🏠

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