

A Multidisciplinary Approach to a Possible Limb-Threatening Infection

[DEPARTMENTS: APWCA CLINICAL ROUNDS]

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Diabetic ulcerations are challenging wounds, and determining effective therapies is a major obstacle for wound care specialists. The presence of infection in the diabetic foot is an especially important clinical problem because lower extremity infections are one of the most common reasons for hospital admission in the diabetic patient. Typically, diabetic patients with lower extremity infections are in their fifth decade and have been diabetics for approximately 18 years. Repetitive stress and improper care of the insensate foot all serve to impair the healing process. The increased risk of having peripheral vascular disease also contributes to infection of the wounds, which can ultimately lead to amputation.

Chronic foot ulcers preceded 70% to 80% of all diabetes-related amputations in 1 study.¹ It is estimated that 50% to 75% of lower extremity amputations could be prevented by modifying risk factors and improving care among individuals with diabetes.² Health care expenditures and medical efforts must be directed at patient education, prevention, early detection, and prompt treatment of foot infections.

Treatment of severe diabetic wounds needs to be multifaceted to prevent possible limb-threatening infections. Along with the traditional "off-loading" or debridement, physicians also use other methods to treat these infections. One possible method of treatment is negative-pressure wound therapy (NPWT), which removes fluids and infectious materials to protect the wound environment and promote healing. NPWT controls the application of subatmospheric pressure to a wound, adding negative pressure to a specialized wound dressing to help promote healing. The NPWT system helps direct drainage to a specially designed canister that reduces the risk of exposure to exudates, fluids, and infectious materials.

Another method of treatment available is hyperbaric oxygen (HBO) therapy, which has been found to successfully treat foot wounds from diabetes, radiation ulcers, and other ischemic wounds. This therapy is designed to increase oxygen delivery to local ischemic tissue to facilitate wound healing. In a recent study, individuals with diabetic foot ulcers were admitted to a hospital for treatment, with a total of 35 patients receiving HBO therapy. Only 3 of the patients undergoing HBO therapy underwent major amputation versus 11 in the non-HBO group.³ In another study, individuals receiving HBO had a 35.7% reduction in wound size at 6 weeks compared with 2.7% in non-HBO subjects.³ These studies indicate that HBO is an effective method for treating diabetic foot wounds, and HBO therapy should be considered an integral part of multidisciplinary wound care.

CASE STUDY

In this study, the patient is a 57-year-old white woman with a family history of diabetes and heart disease. She was diagnosed with type 1 diabetes mellitus in 1987. The patient also has diabetic neuropathy, with loss of feeling in her extremities, as well as diabetic retinopathy. In 1998, the patient was diagnosed with diabetic nephropathy and chronic renal failure, which led to a kidney transplant. She also had her right lower extremity amputated below the knee. Along with her several diabetic complications, the patient has a history of hypertension, which resulted in a hypertensive crisis. A history of transient ischemic attack and paroxysmal supraventricular tachycardia were also noted. Along

with her physical maladies, she was diagnosed with clinical depression and is often noncompliant with physician orders.

The patient has no known drug allergies, and upon admission to the emergency department, she was taking insulin (Humulin), insulin aspart-injectable (NovoLog), atorvastatin calcium (Lipitor), tacrolimus (Prograf), mycophenolate mofetil (CellCept), acetylsalicylic acid (aspirin), magnesium oxide, bupropion (Wellbutrin), and amlodipine besylate (Norvasc).

Examination

The patient was admitted to the emergency department with flu-like symptoms: fever, headache, malaise, and fatigue. She was also hypotensive. The patient was self-treating the multiple diabetic blisters on her foot with a combination of an antibiotic ointment and baking soda. Upon medical workup, her white blood cell count was 24,000/ μ L, and her foot was noted to have an odor, discoloration, boggy of the dorsal and medial aspects of the foot, and cellulitis above the ankle joint. Purulent drainage upon palpation of the area was noted as well. It was also documented that she had early gangrenous changes.

The patient was taken into the operating room for incision and drainage of the abscesses along with surgical debridement of the wound sites. Anesthesia was accomplished with a tibial block because the patient had virtually no sensation. Blood cultures came back positive for streptococcus, and her foot had progressed to methicillin-resistant *Staphylococcus aureus* (MRSA).

The patient was confused during the first 3 to 4 days of her hospitalization as a result of sepsis. A computed tomography scan was performed, which showed no signs of stroke or mass lesion. Her oxygen levels were adequate, and the change in her mental status was attributed to the sepsis. Once the patient was reoriented, she and her family were informed of her poor prognosis.

Treatment

Upon discharge from the hospital, the patient was referred to the Blair Medical Associates Wound Clinic, in Altoona, Pennsylvania. Initially, the patient was intravenously administered ertapenem sodium (Invanz), but she was discharged to the wound clinic by the infectious disease physician on vancomycin for her MRSA infection. Throughout the course of her antibiotic regimen, she was managed by infectious disease specialists.

During the initial examination at the wound clinic, the patient showed no signs of rash on her extremities, but several foot wounds, as well cellulitis above the left ankle, were noted. She was also noted to have ortho-Charcot of the left foot, and her Achilles reflex was absent. Upon neurological examination, the patient showed no vibratory and proprioceptive sensations and no sensation in the Semmes-Weinstein monofilament testing of the lateral foot.

The patient presented with 7 wounds. Wound 1 was 5.3 cm in length, 4.8 cm in width, and 1.4 cm in depth. The wound was located on the dorsum of her left foot with wound tunnels 1.3 cm at 11-o'clock position ([Figures 1, 2, and 4](#)). The bone and tendon were exposed. Wound 2 was 3.3 cm in length, 1.5 cm in width, and 1.6 cm in depth. The wound was located on the dorsum of her left foot with no tunneling or undermining noted ([Figures 1, 2, and 4](#)). Wound 3 was 1.4 cm in length, 1.6 cm in width, and 1.5 cm in depth. The wound was located on the lateral left foot with no tunneling or undermining noted ([Figures 2 and 4](#)). Wound 4 was 3.2 cm in length, 3.8 cm in width, and 0.7 cm in depth. The wound was located on the medial aspect of the left foot with wound tunnels 2.5 cm at 1-o'clock position ([Figure 1](#)). Wound 5 was 1.6 cm in length, 3 cm in width, and 0.2 cm in depth. The wound was located on the plantar surface of the left foot with no tunneling or undermining noted ([Figure 3](#)). Wound 6 was 0.4 cm in length and 1 cm in width, and the wound was located on the left heel ([Figure 3](#)). Wound 7 was 0.5 cm in length, 0.6 cm in width, and 2.6 cm in depth. The wound was located on the third web space of the left foot with no tunneling or undermining noted ([Figure 4](#)).



Figure 1. No caption available.

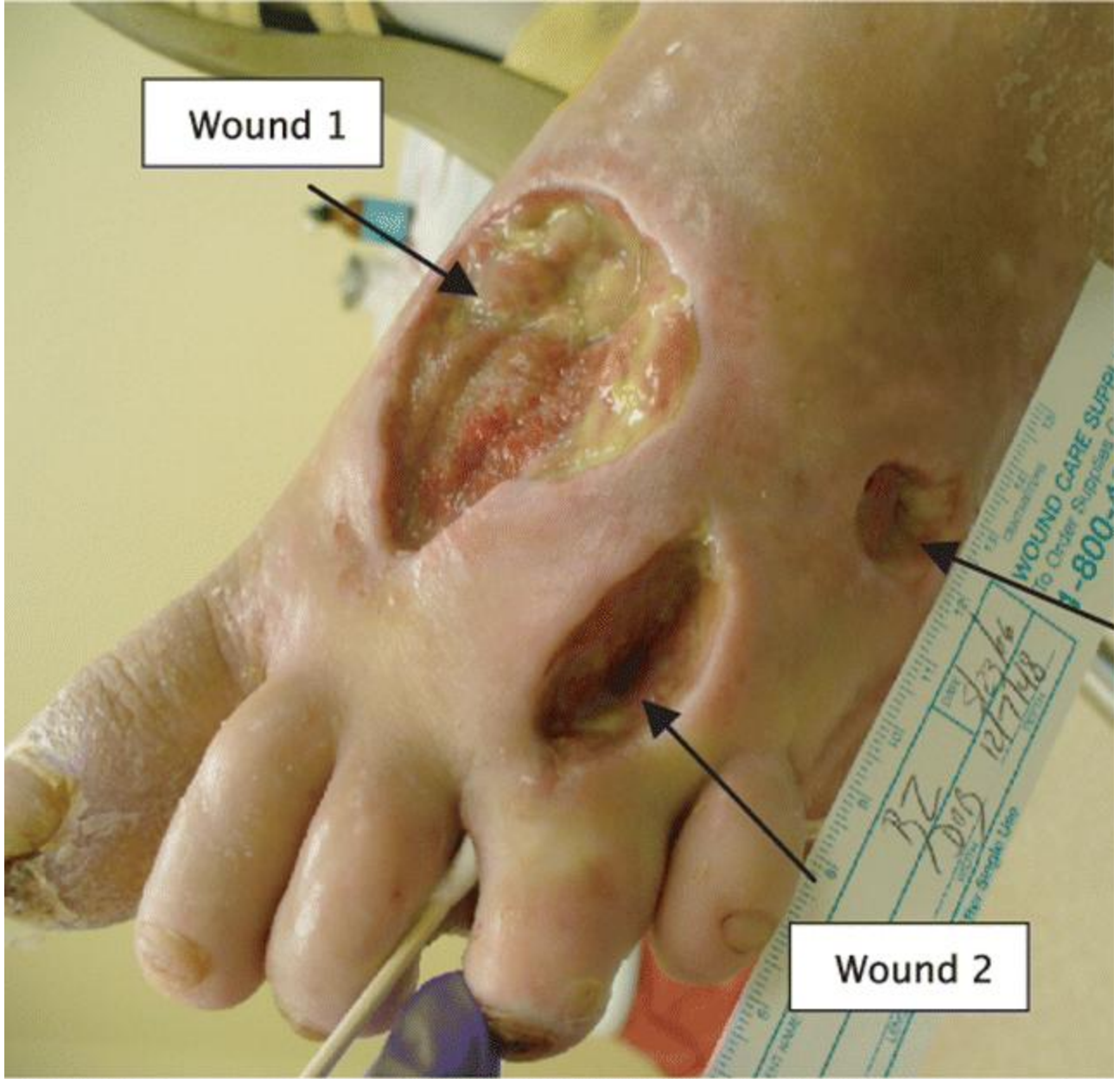


Figure 2. No caption available.



Figure 3. No caption available.

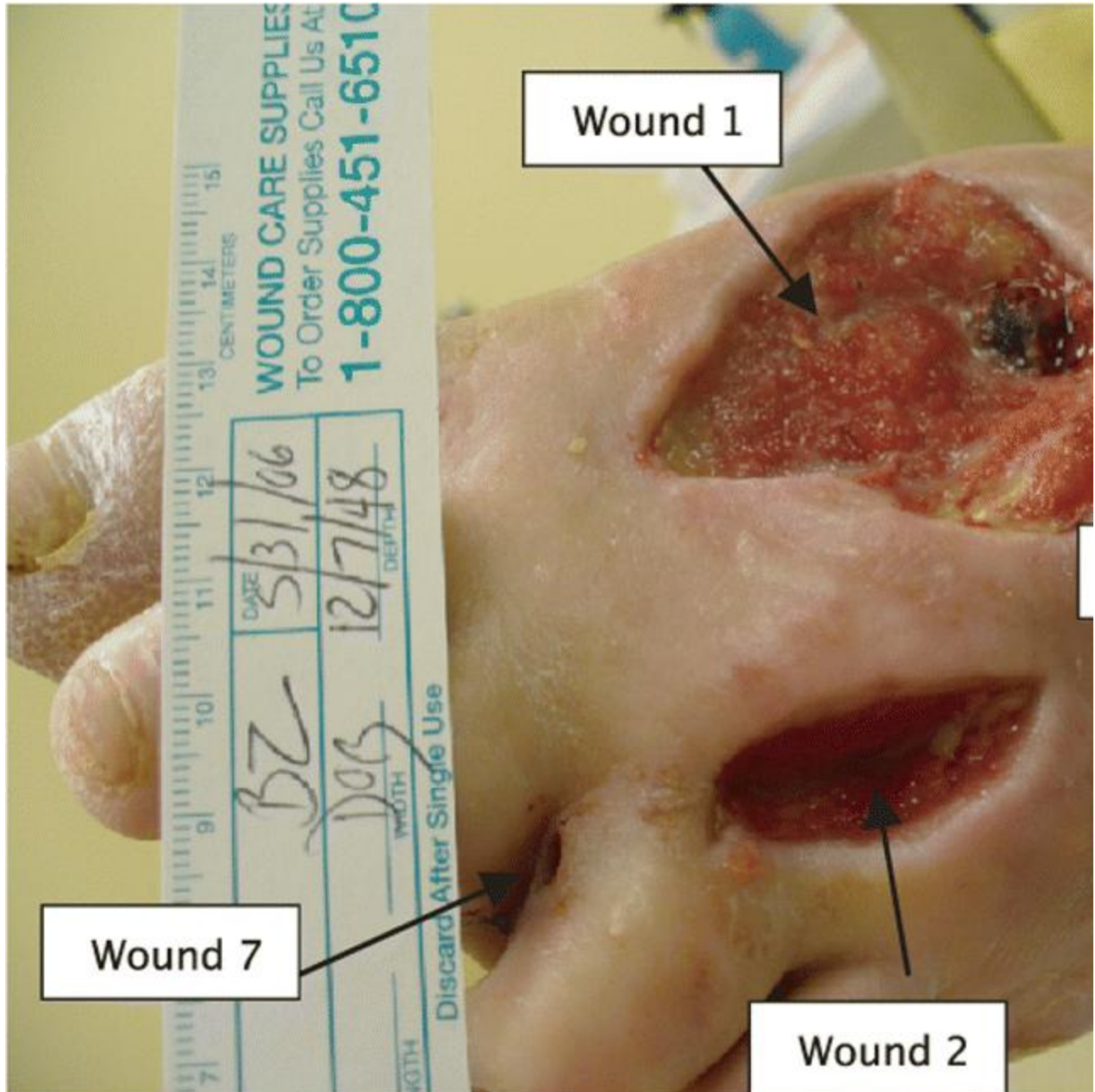


Figure 4. No caption available.

Initially, the wounds were treated with enzymatic debridement with Accuzyme (Healthpoint, Fort Worth, Texas). Home nursing was consulted for wound dressing changes. Two weeks later, the patient had NPWT applied to both the dorsal wounds and also to the medial and lateral wounds with 125 mm Hg of continuous vacuum. Silvasorb gel (Medline, Mundelein, Illinois) was applied to the web space and plantar wounds. By the fifth week of treatment, the patient had only the 2 dorsal wounds present. The vancomycin was discontinued at this time after 6 weeks of therapy. Consistent with her history of noncompliance, she missed several appointments and was not present when home nursing visited her at home for treatment.

When the patient finally followed up at the wound clinic after neglecting care, she presented without her NPWT device, and her foot appeared to be infected. She received a bone culture, and MRSA was evident. She was administered intravenous vancomycin again, but due to her continued noncompliance,

she delayed the start of therapy by 2 weeks. At this time, it was stressed to the patient that the probability of loss of limb was high, and continued nonadherence was detrimental to a positive outcome. The patient was then referred for HBO therapy.

The patient had a total of 30 HBO treatments. During the course of treatment, she was once again noncompliant, but nevertheless, after the prolonged treatment, the patient healed considerably. She was also given another 6-week regimen of vancomycin while receiving HBO therapy. At 11 weeks after her initial treatment, the wounds were completely healed ([Figures 5 and 6](#)).



Figure 5. No caption available.



Figure 6. No caption available.

CONCLUSION

The authors conclude that the only reason the patient's extremity was able to be salvaged was because of the use of multiple modalities to accomplish healing. A multidisciplinary approach allowed the clinicians to adapt to this medically complex patient, as well as adapt to her history of noncompliance. It took certified wound care nurses, physicians, an infectious disease specialist, and an HBO specialist to provide the most appropriate care for this patient. The authors highly recommend this multidisciplinary approach to heal complex wounds.

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[\[Medline Link\]](#) [\[CrossRef\]](#) [\[Context Link\]](#)
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