Potassium permanganate warm bath and povidone-iodine wet dressing for diabetic septic foot an innovative method

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Abstract:

Background: Diabetic foot ulcers (DFUs) are one the major causes of morbidity and disability in diabetic patients. It is the consequence of multiple factors including peripheral neuropathy, and decreased blood supply. The management of (DFUs) remains a major therapeutic challenge to treating physicians, surgeons, and other healthcare professionals. topical potassium permanganate and povidone-iodine significantly accelerate the healing process, and the warm baths improve blood circulation of the foot, these case series aim to study the benefits of the combination of these three modalities. **Methods**: This is a case series study of ٧ patients who have infected diabetic ulcers Grade 3 or more Wagner's classification, with foul smell, and minimal granulation tissue. Treated by Potassium permanganate warm bath for 10- 15 minutes followed by povidone-iodine wet dressing. **Results**: 2 females and 5 males The Mean age was 62 all the cases improved, and the foul smell disappeared on the second day of the procedure. The patient and the family are happy with the results, and the ulcers were cured in 2-4 months. **Conclusion**: Potassium permanganate warm bath and 10% povidone dressing were effective in DFU (Wagner grade three or more) saving the foot from amputation.

Keywords: Diabetic foot ulcers, Diabetic septic foot, potassium permanganate, povidone-iodine, warm bath

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حمام دافئ ببرمنجنات البوتاسيوم والضمادات الرطبة بالبوفيدون ايودين للقدم السكرية الإنتانية طريقة مبتكرة

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خلاصة

الخلفية: قروح القدم السكرية هي أحد الأسباب الرئيسية للمراضة والإعاقة لدى مرضى السكري. وهي نتيجة لعوامل متعددة بما في ذلك الاعتلال العصبي المحيطي، وانخفاض إمدادات الدم. يظل علاجها تحديًا كبيرًا للأطباء والجراحين وغيرهم من المتخصصين في الرعاية الصحية. تعمل برمنجنات البوتاسيوم الموضعية والبوفيدون على تسريع عملية الشفاء بشكل كبير، كما تعمل الحمامات الدافئة على تحسين الدورة الدموية في القدم، وتهدف سلسلة الحالات هذه إلى دراسة فوائد الجمع بين هذه الطرق الثلاث: **الطريقة:** هذه دراسة سلسلة حالات لـ ٧ مرضى مصابين بقرحة القدم السكرية من الدرجة ٣ أو أكثر من تصنيف فاغنر، مع رائحة كريهة، وأنسجة حبيبية قليلة. حمام دافئ ببرمنجنات البوتاسيوم لمدة ١٠ – ١٥ دقيقة يليه ضمادة مبللة بالبوفيدون.**النتائج:** ٢ إناث و ٥ ذكور متوسط العمر ٦٢ سنه جميع الحالات تحسنت، اختفت الرائحة الكريهة في اليوم الثاني من تطبيق هذه الطريقه, المريض والأسرة سعيدة بالنتائج، تم شفاء القرحة خلال ٢–٤ أشهر. الاستنتاج: كان الحمام الدافئ ببرمنجنات البوتاسيوم وتضميد البوفيدون ١٠٪ فعالين في علاج القدم السكرية من درجة فاغنر الثالثة أو أكثر لإنقاذ القدم من البتر.

الكلمات المفتاحية: قرح القدم السكرية، القدم الإنتانية السكرية، برمنجنات البوتاسيوم، البوفيدون ايودين، حمام دافئ

Introduction:

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Diabetic foot ulcers (DFUs) are one of the major causes of morbidity and disability in diabetic patients. They are often the common cause of amputations when they are associated with ischemia or neuropathy. 6.9% of patients are affected by diabetics during their lifetime [1]. Ulcerations are the most common cause of amputations. These ulcers were also loaded with resistant bacterial strains that hinder the healing, moreover, there were drug side effects and organ toxicity [2]. Peripheral sensory neuropathy is one of the major reasons for ulcer formation. The decrease in sensation allows trauma to go unnoticed. Ulcers develop in areas with increased pressure, commonly the heel or toes. Sensory loss, motor deficits, and muscle weakness may result from injury or nerve damage. The neuropathy causes a decrease in the sensation of pain and temperature in the foot. This combination of motor and sensory loss causes a change in the foot mechanics, causing pressure ulcers. This increases the risk of ulcer formation. [3, 4] The other major factor in foot ulcer development is peripheral arterial disease caused by plaque build-up in the arteries, which eventually decreases blood flow to the small vessels in the feet. There is a decrease in blood flow, and wounds cannot heal due to the lack of oxygen, nutrients, and white blood cells provided by blood. With the combination of peripheral neuropathy, change in foot mechanics which increases the possibility of trauma, and lack of blood flow to the lower limb, diabetic patients are vulnerable to ulcers of the foot with delayed healing of these wounds in the usual periods [5, 6]. The management of DFUs remains a major therapeutic challenge to treating physicians, surgeons, and other healthcare professionals. There is an urgent need for new strategies with clinically effective medicines to treat DFU to reduce the burden of care efficiently and cost-effectively.

Delgado-Enciso et al tried topical potassium permanganate (PP) and the result was promising it was well tolerated and significantly accelerated the healing process [7]. Topical PP was used in leg ulcers and it was found to reduce ulcer size [8]. Insufficient blood supply often occurs in the lower extremities in people with microcirculation disorder, especially in people with diabetes, and a warm bath via warm water immersion causes

vasodilatation in the microcirculation and improves foot blood supply [9, 10].

Povidone iodine has been used and tested in wound healing for many decades. The microbicidal activity of Povidone iodine involves the inhibition of vital bacterial cellular mechanisms and structures. Povidone iodine kills a variety of bacterial strains that cause nosocomial infections, including methicillin-resistant Staphylococcus aureus (MRSA) and other antibiotic-resistant strains within 20-30 s of exposure, and it has anti-inflammatory properties, but it is less effective if oozing or exudate is predominant it is more effective with compression dressing [11, 12]. In this case series study, we tried to get the benefit of the local heat via PP warm bath which washes the exudates and improves the effect of povidone-iodine.

Methods and subjects:

This is a case series study of ٧ patients with infected diabetic ulcers Grade 3 or more according to Wagner's classification [13] Table 1, with foul smell, and minimal granulation tissue, 2 females and 5 males. The Mean age was 62 All of them were diabetic type 2.

Wound care technique

1- Potassium permanganate (pp) warm bath for 10-15 min.

pp solution was prepared from 2 grams of pp crystals dissolved in one bottle of mineral water which gave us a concentrated solution with a dark purple color, this solution is used for several warm bathes by taking about 50 ml of it poured into a basin containing warm water fig 1, this pp warm bath at a concentration one part per 5000-10000 and temperature 40-45 c tested by the caregiver was used for emersion and wash of the DFU for 7 – 10 minutes with a little squeeze of the foot to wash the exudates.

2- Povidone iodine wet dressing:

After the PP warm bath, the ulcer was cleaned with dry gauze and then warped with a 10% povidone-iodine-soaked gauze kept over the ulcer and covered with dry gauze and crepe bandage. The warm bath and dressing were repeated twice daily at the beginning until clean granulation tissue was seen then once daily.

Training of the caregiver to do the warm PP bath at home was done during the patient's stay in the hospital. and

after discharge an outpatient clinic visits, weekly, every ten days, or when convenient or necessary until the wound is closed.

Results

All patients have good healing ulcers within 2 months for the big ulcers it takes up to 4 months the foul smell disappears the next day of the procedure. Patients and families were satisfied with the results.

Case 1: a 67-years-old male diabetic psychotic with a severely infected foot with a foul smell, amputation was decided for him by the surgeon but the family refused we tried the pp warm bath IV antibiotics, supportive multivitamins, calcium, and iron tablets [14, 15] at the hospital for one week with good improvement Fig 2.

Case 2: A 68-years-old male came with gangrene in the big toe and medial side of the foot, amputation was decided by the surgeons also but they refused, PP was applied 2 times before debridement to remove the dead tissue, then PP warm bath twice per day for 5 days at the hospital with good improvement fig. 3. The patient was discharged to continue wound care at home after training his son.

Case 3: A 62-year-old female came with an infected big toe and multiple sinuses, the procedures were explained to her son in the outpatient clinic and a weekly visit was arranged, she improved within two months Fig. 4.

The other four cases have smaller infected foot ulcers treated at the outpatient clinic with a demonstration of the wound care technique all of them were cured in 2-4 months.

Discussion: In this case series the foul smell disappeared from the second day of the treatment, the patient (this is probably due to the antiseptic effect of the pp bath and povidone-iodine wet dressing), and family were satisfied and continued the treatment at home with enthusiasm and came for follow-up, we found this method was effective, safe and efficient in stopping ulcer deterioration, debriding it, washing and reducing the exudate and microbial load, and promotes healthy granulation. there are several studies comparing povidone-iodine with other methods of dressing, like saline, honey, superoxide, and others [16-20], and

reported different degrees of effectiveness.

Delgado-Enciso, et al used PP 5% concentration and found it effective in cases of intolerance [7]. In our study we used a concentration of one part per 5000-10000, the concentration usually used for dermatological wounds and cellulitis [٢١, ٢٢] with the addition of a warm bath which is effective in washing the exudate, acts as antiseptic and improves blood flow to the already compromised diabetic foot vascularity, this effect was found by killer et al, Ren et al and Romero et al [٩, ١٠, ٢٣]. The combination of these three methods (local heat by foot emersion in a warm pp bath, PP wash of the diabetic ulcer, and wet povidone iodine dressing) was effective, and we found no study combined these three methods.

Conclusion: The use of PP warm bath and 10% povidone-iodine dressing was effective in DFU (Wagner grade three or more) saving the foot from amputation.

Limitations: This is a case series study with a low level of evidence, a randomized control trial is needed to strengthen the evidence we found

Fig 1: Potassium permanganate warm bath preparation

Fig 2: case 1

Fig 3: Case 2

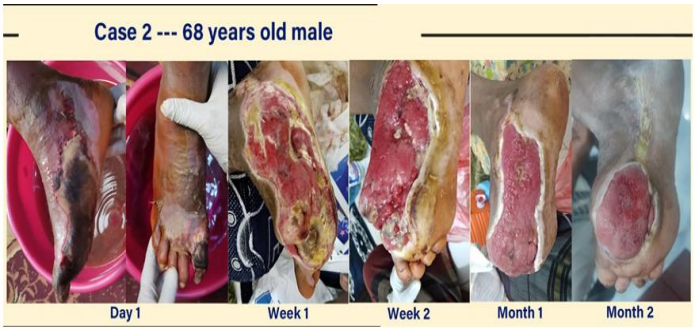

Fig 4: case 3

Table 1:

Wagner's classification of diabetic foot ulcers

Wagner's Classification	
Grade 0	Skin intact but bony deformities lead to "foot at risk"
Grade 1	Superficial ulcer
Grade 2	Deeper, full-thickness extension
Grade 3	Deep abscess formation or osteomyelitis
Grade 4	Partial Gangrene of forefoot
Grade 5	Extensive Gangrene

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