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Polyhexamethylene biguanide dressings in the treatment of a wound. A case report

Apósitos de polihexametileno biguanida en el tratamiento de una herida. Reporte de caso

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Keywords: polyhexamethylene biguanide, dressing, chronic wounds, diabetic foot.

Palabras clave: *polihexametileno biguanida, apósito, heridas crónicas, pie diabético.*

ABSTRACT

The diabetic foot has become one of the most important chronic complications of diabetes. One of the treatments that still need to be systematized is polyhexamethylene biguanide (PHMB) dressings because its recent use in wound treatment is recent. We present the case of a patient with an extensive wound in a pelvic limb stump, which was managed with PHMB dressings, presenting complete closure in 11 weeks without the need for surgery. Currently, there is little scientific evidence about the impact of these dressings in treating wounds caused by diabetic complications; however, their routine use could be satisfactory in the closure of chronic wounds, as demonstrated in this case.

RESUMEN

El pie diabético se ha convertido en una de las complicaciones crónicas más importantes de la diabetes. Uno de los tratamientos que aún no se encuentra sistematizado es el uso de los apósitos de polihexametileno biguanida (PHMB) debido a que su uso en el tratamiento de heridas es reciente. Se presenta el caso de un paciente con una herida extensa en muñón de miembro pélvico, la cual fue manejada con apósitos de PHMB, y presentó cierre completo en 11 semanas sin necesidad de cirugía. Actualmente se cuenta con poca evidencia científica acerca del impacto de estos apósitos en el tratamiento de heridas producidas por complicaciones de la diabetes; sin embargo, su empleo de forma rutinaria podría resultar satisfactorio en el cierre de heridas crónicas como lo demuestra este caso.

INTRODUCTION

One of the chronic complications currently considered a public health problem is the diabetic foot because it affects people's quality of life, causes disability, has a high social cost, entails high economic losses, and requires specialized treatment.[1] The prevalence of diabetic foot worldwide varies from 13% in North America to a global average of 6.4%. This prevalence is higher in men than in women. In high-income countries, the annual incidence of diabetic ulcers is about 2%, the most common cause of non-traumatic amputation. In low- and middle-income countries, amputations are even more common. In 2007, one-third of the global cost of diabetes was allocated to the diabetic foot. In addition, the cost of managing patients with foot ulcers is 5.4 times higher than those without diabetic foot.[2]

In Mexico, the 2012 National Health and Nutrition Survey (ENSANUT) revealed that the proportion of ulcers was 7.2%, and the proportion of amputations was 2%. In 2016, a significant increase in the proportion of people with ulcers was 9.1%, and the proportion of amputations was 5.5%.[3]

Prevention, timely detection, and education of patients and their families or caregivers offer the possibility of reducing

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the development of ulcers and amputations, as well as maintaining the quality of life, functionality, and productivity according to each patient's age. Diabetic foot ulcers could be prevented by adequately detecting risk factors, classifying, and applying preventive measures.[4] Nowadays, there are many instruments to evaluate wounds; however, those with the highest number of prognostic variables in healing should be used, such as patient history, wound size, tissue type, exudates, pain, and signs of infection, in addition to being easy and quick to use.[5]

Treatment involves surveillance of the different etiologies and in-control interventions to improve prognosis.[6,7] Among the many therapeutic options, surgical debridement, which is the most controlled and efficient technique, and dressings that provide a barrier against external forces and contaminants and promote absorption of exudate around the ulcer, stand out.[8] There are a variety of dressings available along with more advanced methods to accelerate wound healing;[9,10] of these, the most commonly used prototype is polyhexamethylene biguanide (PHMB), also known as polyhexanide, classified within bactericidal dressings. It is an antiseptic and disinfectant agent that acts on multiple factors and reduces the probability of bacteria generating resistance mechanisms; it acts against several pathogens, including *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas* and *Candida albicans*; it also functions as a barrier that prevents the entry of new microorganisms into wounds and reduces biofilms in the wound bed.[11]

In 2017, Mancini tested the efficiency of a PHMB dressing to decrease bacterial load in wounds. At seven days, the group of patients with conventional treatment had 21-40% granulation tissue formation, while patients with PHMB had 41-50% in the same period.[12]

PRESENTATION OF THE CASE

We present the case of a 79-year-old male patient with a history of type 2 diabetes and arterial hypertension of 35 years of evolution, with adequate control. He has a history of infracondylar amputation due to a diabetic foot in 2012, receiving rehabilitation for two years, and being a candidate for prosthesis use.

In August 2019, as a result of the constant trauma of the prosthesis on the residual limb, he developed an ulcer *(Figure 1)*, which evolved unfavorably, increasing ischemia and presenting soft tissue necrosis and tibia exposure *(Figure 2)*; the reason for which he is presented to the Emergency Department of the General Hospital of Mexico, attended by the General Surgery Service, performing Doppler ultrasound with a report of absence of distal arterial flow in 90%, meriting supracondylar amputation, which was carried out in November 2019 with the following findings: soft tissues without the presence of infection or edema, femoral artery and vein occluded by atheroma plaque in 95% of its lumen. He received antibiotic therapy with amoxicillin/clavulanate 875/125 mg for seven days every 12 hours. He was discharged on the ninth postoperative day; two weeks later, the patient attended a follow-up consultation, showing a significant increase in volume in the stump, erythema and increased local temperature, macerated edges of the surgical wound, and scarce fibrin creations; A thigh X-ray was performed, finding images suggestive of gas, so it was decided to partially remove the suture,

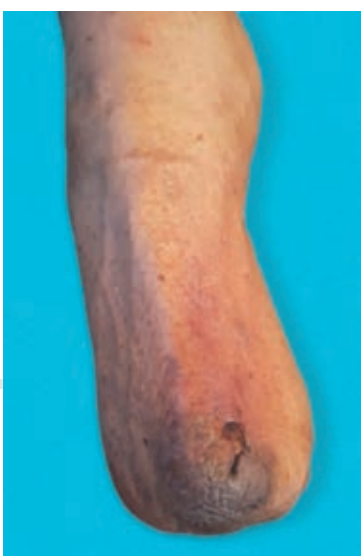

Figure 1: *Superficial ulcer.*

Figure 2: *Tibial exposure and tissue necrosis.*

draining 800 cm^3 of serous fluid, not fetid and the presence of three tracts, the largest of them in the anteromedial compartment of the thigh of approximately 15 × 8 × 8 cm *(Figure 3)*. A basal wound culture was taken without development. Outpatient treatment was started by irrigation with a physiological solution at 0.9% physiological solution for two weeks, without achieving adequate closure, which is why it was decided to implement management with PHMB dressings, which are internalized in the trajectories, occupying the entire dead space to the outer edge of the wound with prior aseptic technique (surgical soap and sterile saline solution), in addition to debriding fibrin creations of the edges, as well as devitalized tissue with a scalpel; Dressings were changed every five days, observing during each healing the closure of the tracts with the formation of granulation tissue in proximal to distal direction; at four weeks of treatment, a 60% reduction in the size of the wound was observed *(Figure 4)*, using less dressing with complete granulation at each new revision at eight weeks *(Figure 5)*, until presenting complete wound closure 11 weeks after starting treatment *(Figure 6)*. Currently, the patient has no complications of the residual limb and continues to be followed up for systemic pathologies.

DISCUSSION

The reported case deals with a deep non-infected wound that extends beyond the fascia; there is no literature in which PHMB therapy has been implemented in patients with these characteristics, although its use in superficial wounds has been described. Although there are

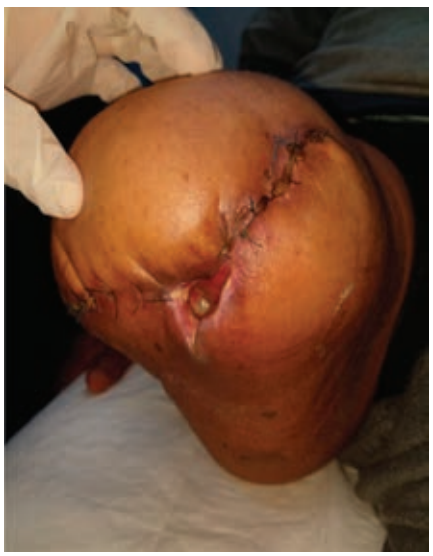

Figure 3: *Dehiscence of the surgical wound. Multiple tracts encompassing muscle fascia are seen.*

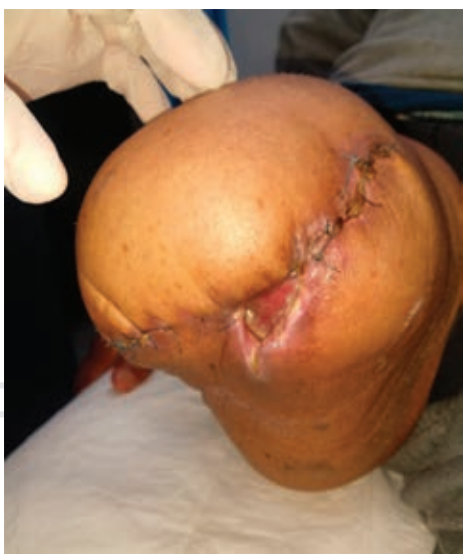

Figure 4: *Wound granulation after four weeks of treatment with polyhexamethylene biguanide.*

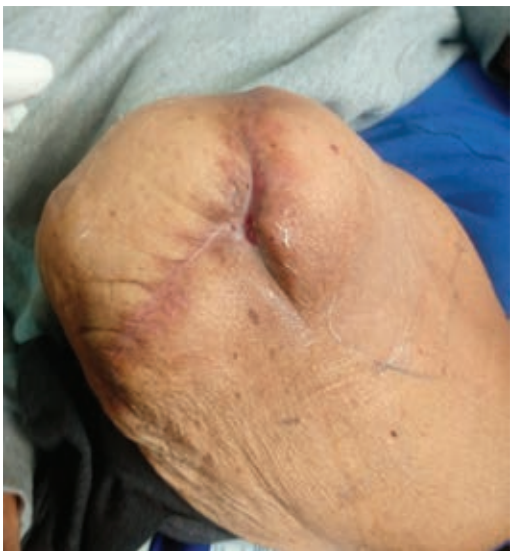

Figure 5: *Wound closure after eight weeks.*

national and international guidelines, there is little evidence about routine care. The average time to heal a superficial diabetic foot wound without surgery is approximately 12 weeks. Wound healing is successful when the wound area is reduced to at least 50% of its initial size during four weeks of treatment.

In his study, Elraiyah T mentions that surgical debridement versus conventional management with simple dressings reported a healing rate of 95% in the surgical group,[13] compared to 79.2% in the group with dressings. In the case we present, complete closure was achieved in 11 weeks, and four weeks after treatment, the patient presented a decrease in wound size of 60%; it should be noted that in our case, we combined both techniques to improve wound characteristics.

Regarding healing days, the surgical group in the Elraiyah T study had a healing time of 46 ± 39 days, the conventional group 129 ± 86 days; in our case, total wound closure was completed in approximately 75 days.[13]

In the study by Sibbald RG in 2011, they used a population and methodology similar to ours. At four weeks, it was found that in the group with PHMB, the mean decrease in wound surface area was 35% versus 28% of the control group; in the case of our patient, the results support their conclusions because it was observed that wound closure was 60% at four weeks and 100% epithelialization was present at 11 weeks.[14]

No infection was identified in our case post-treatment, compared to the report of Elraiyah T, who found up to 12.5% in the dressing group. However, his results were statistically no significant.

Dressings with PHMB are an excellent alternative for treating diabetic foot wounds, used with empirical antibiotic therapy and conventional cures. In the case we present, we observed a reduction and complete closure of the wound, reduction of the infectious focus and the need for surgical reintervention, remodeling of the stump, or even elevation of the amputation level with the use of PHMB, which translates into an improvement in the patient's quality of life, avoiding the risks and trauma inherent to surgical procedures, as well as a reduction in costs, since the total cost of the therapy used was only 74 Mexican pesos.

Following what has been observed in this case and the literature on the benefits of treatment with PHMB for patients with diabetic foot, it is suggested to continue research on the subject, developing a multidisciplinary research protocol and including a significant population to increase the level of scientific evidence

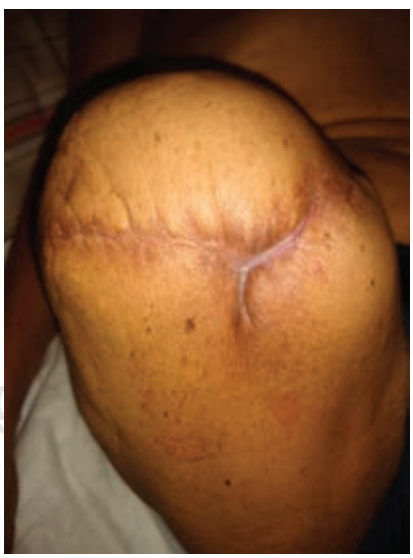

Figure 6: *Complete epithelialization of the wound after 11 weeks.*

to continue with scientific development and knowledge.

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