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Combination treatment of a deep diabetic toe ulcer with collagenase-santyl dressings and antibiotics: A case report

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ABSTRACT

A diabetic foot ulcer is defined as the ulceration of tissues brought on by trauma and some peripheral neurological abnormalities, primarily as a result of the bacterial infection. The infection of the toe's surrounding tissue is the primary cause of the infectious diabetic toe ulcer. In this case report, a 58-year-old male patient with a deep foot ulcer was admitted to the emergency ward on October 15, 2022, due to pus discharge at the right big toe of the foot. Antibiotics like Vancomycin 30mg per kg twice per day and Ciprofloxacin 400mg twice per day were suggested, along with enzymatic debridement therapy, which helps stop infections faster. A decrease in wound size and an improvement in overall health showed that the patient's response to the combination therapy was encouraging. The use of collagenase-santyl dressings, along with suitable antibiotics, can play a crucial role in the successful treatment of foot ulcers by facilitating wound healing and preventing complications like cellulitis or osteomyelitis.

1. Introduction

The surface of the skin and underlying tissues are severely damaged due to traumatic ulceration. However, in diabetic conditions, ulcers are most commonly found in the lower region of the limbs, and the infection or wound healing may be prolonged due to type II diabetes mellitus.[1] Many investigations are aimed at reducing infection in certain areas of the ulcers in patients with diabetes. In the case of diabetic foot ulcers, there is a rapid spread of the infection that increases the surface area of the wound due to microbial growth. The microbes feed on glucose or sugar, which increases the energy content of the tissue-altering cell cycle, which results in cell necrosis, and the microbial debris causes tissue damage, facilitating the aggressive growth of microbes.[2] In many clinical assessments, it was found that in an elderly age group with type II DM, infection severity is most common, which has a great impact on the health-related quality of life (HQRL) of the patient. The user's input suggests that debridement therapy has been found to be effective in managing infections in patients with type II DM. The combination of antibiotics mentioned not only helps control the microbial infection but also aids in preventing further complications.[3] The user emphasises the importance of closely monitoring the patient's response to this therapy and adjusting the treatment plan accordingly for optimal results. The key words mentioned include enzymatic debridement therapy, angiogenesis, reepithelialization, and collagen santyl. Enzymatic debridement therapy, a crucial component in wound management, has shown promising results in patients with type II DM. This technique involves the application of specific enzymes to break down necrotic tissue, promoting wound healing and preventing infection.[4] Additionally, the user highlights the significance of angiogenesis, the formation of new blood vessels, in the healing process. By enhancing blood flow to the affected area, angiogenesis plays a vital role in delivering essential nutrients and oxygen for tissue repair. Another crucial aspect that the user emphasises is reepithelialization, or the regeneration of the skin's outermost layer. This process involves the migration of epithelial cells to cover the wound, forming a protective barrier against pathogens and reducing the risk of infection.[5] By utilising specific enzymes, promoting angiogenesis, and enhancing reepithelialization, the healing process can be accelerated and complications minimised, leading to quicker and more successful wound

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healing. However, in certain cases, such as chronic wounds or conditions like diabetes, the process of reepithelialization can be impaired.[6] This can result in delayed wound healing and increased susceptibility to infections, despite the use of enzymes and antigenic factors. Therefore, it is crucial to consider individual factors and underlying conditions that may hinder the effectiveness of these techniques in promoting wound healing.[7] In this study, we report that by following the enzymatic debridement therapy along with antibiotics continuously, the site of the amputation gets healed, and recovery may take 30 days. However, it is important to note that the effectiveness of enzymatic debridement therapy and antibiotics may vary depending on the severity of the wound and the overall health of the individual. Additionally, close monitoring and proper wound care management are essential to ensuring optimal healing outcomes.

2. Case report

A 58-year-old male patient with a deep foot ulcer was admitted to the emergency ward on October 15, 2022, due to pus discharge at the right big toe of the foot (Fig. 1). The patient had tachycardia and type II diabetes mellitus. The patient was treated with empirical antibiotics like linezolid and cephalexin without knowing about the microbial infection. The patient's wound was thoroughly cleaned and debrided to remove any dead tissue and promote healing. Cultures were taken from the wound to identify the specific microbial infection and guide targeted antibiotic therapy. The patient's wound surface area rapidly increased due to the infection's severity, leading to amputation. Enzymatic debridement therapy, specifically collagen santyl dressings, was applied to the wound surface to promote angiogenesis and reepithelialization. Metformin is an oral medication that controls blood sugar levels. The usual dose of metformin is 500 mg (mg) twice a day, used to control the blood sugar level. Additionally, regular monitoring of blood sugar levels and regular checkups with the healthcare provider are essential to ensure that the medication is working effectively and to make any necessary adjustments to the treatment plan. This therapy, along with supportive antibiotics like Vancomycin 30mg per kg twice per day and Ciprofloxacin 400mg twice per day, is given for wound healing. A decrease in wound size and an improvement in overall health showed that the patient's response to the combination therapy was encouraging. Regular monitoring of the wound and microbial cultures allowed for timely adjustments in antibiotic treatment, ensuring effective control of the infection. The patient was cured at 55 % and discharged after 30 days of therapy (Fig. 2). The medical team closely monitored the patient's progress during the entire treatment period, adjusting the therapy dosage accordingly.

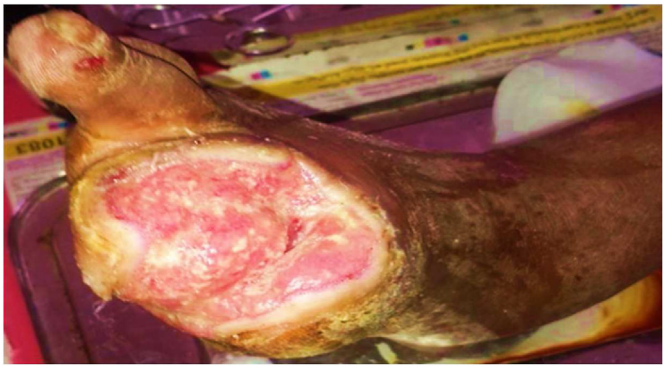

Fig. 1. Picture of a toe sore on the 15th day of treatment.

Fig. 2. Ulcer healing on the 30th day of the treatment.

3. Discussion

A diabetic foot ulcer is defined as the ulceration of tissues brought on by trauma and some peripheral neurological abnormalities, primarily as a result of the bacterial infection. Some pathophysiological, environmental, and anatomical changes influence ulceration.[8] The statistical data literature of the survey suggests that 5 % of people with diabetes develop foot ulcers, and diabetes is the main leading cause of traumatic ulceration of the tissue. Some other statistical studies suggest that 10 % of the patients with diabetes develop foot ulcers, and 15–18 % of the individuals with foot ulcers require amputation.[1] It is crucial to use appropriate wound dressings for diabetic patients with deep foot ulcers to achieve optimal healing outcomes. These dressings not only reduce the risk of infection but also promote faster healing and prevent complications such as cellulitis or osteomyelitis.[2] However, it is important to consider any allergies the patient may have to the components of specialised dressings, as their use could worsen the wound and increase the risk of infection and complications. In this case, the wound did not heal for a few weeks after the empirical therapy, and the infection got worse, leading to the amputation of an affected area. Due to type II DM, there is a decreased elasticity of the arteries, causing vascular diseases at the lower extremities of the limbs. The maintenance of sugar levels in the body is the primary criteria for the treatment of foot ulcers. Enzymatic debridement agents, along with antibiotics, suppressed the infection, and reepithelialization was slowly achieved.[3] Enzymatic debridement agents like collagenase santyl, which is an extract of collagenase, help break up and remove dead skin, which helps angiogenesis and reepithelialization. Additionally, collagenase santyl has been found to enhance the wound healing process by stimulating the production of growth factors and cytokines. This can further aid in reducing inflammation and promoting tissue regeneration. Overall, the use of enzymatic debridement agents like collagenase santyl can play a crucial role in the successful treatment of foot ulcers by facilitating wound healing and preventing complications.[9] Antibiotics like vancomycin, and Ciprofloxacin were used to reduce the bacterial infection at the site of amputation. Vancomycin is a protein synthesis inhibitors; they mainly bind to bacterial 50S ribosomal subunits and inhibit protein synthesis. These are the antibiotics that, at lower doses, act as bacteriostatic agents, while at higher concentrations, they also act as bactericidal agents.[6] The result obtained from this study was matched with other previous studies, but we have not noticed Peripheral arterial disease (PAD) in this patient. Due to an aggravated infection of the necrotized toe region, it was amputated. In diabetic foot ulcers, amputation of the affected region is preferred and performed only

due to an aggressive microbial infection that decreases blood flow to that affected tissue, resulting in necrosis and degradation of the ulcerative tissue of that affected region.[3] Hence, enzymatic debridement agents, along with suitable antibiotics, are the preferred treatment for diabetic foot ulcers.[7] Enzymatic debridement agents are effective in removing necrotic tissue and promoting wound healing by breaking down the dead tissue.[10] They help create an environment conducive to healing and prevent further infections. In addition, suitable antibiotics are prescribed to target the specific bacteria causing the infection and prevent its spread to other areas of the foot.

4. Conclusion

Finally, using collagenase-Santyl dressings along with antibiotics was found to be the best way to treat a deep skin ulcer caused by diabetes. The collagenase-Santyl dressings helped to debride the wound and promote granulation tissue formation, while the antibiotics assisted in preventing infection and promoting healing. The dressings removed dead tissue, promoting healthy growth and faster wound healing. Antibiotics prevented further complications or infections, ensuring a successful recovery. This case report highlights the importance of a multidisciplinary approach and showcases the potential benefits of combining different treatment modalities for better outcomes in diabetic foot ulcers.

CRediT authorship contribution statement

Salkapuram Sunil Kumar: Conceptualization, Data curation. **Karthikeyan Elumalai:** Formal analysis, Funding acquisition. **Srinivasan Sivannan:** Investigation, Methodology, Project administration. **Sivaneswari Srinivasan:** Software, Supervision, Validation. **Santhana Krishnan Ramanujam:** Visualization, Writing – original draft. **Binoy Varghese Cherian:** Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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