

## Diabetic Foot Ulcer on Coronavirus Patient

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**Background:** Corona virus (COVID 19) is an infection caused by a severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The manifestation is from mild symptoms to severe symptoms such as respiratory failure and death. The severity of symptoms that arises in COVID-19 patients is influenced by the comorbidities they have. One of the comorbidities is diabetes. Increasing blood viscosity and severe inflammation occur in the body of COVID-19 patients. Meanwhile, problems such as coagulation factors, body blood flow, disorders of the nerves, lowering the immune response also occur in diabetic patients and etc. One of the complications of diabetes that often occurs is diabetic foot ulcers. The wound will be aggravated by a bacterial infection, such as hemolytic Streptococcus. Delay in diabetic ulcer treatment increases the incidence of amputation, sepsis and death. One of the therapies for diabetic foot ulcer is negative pressure wound therapy (NPWT). NPWT has a higher total cure rate, shorter healing time, and fewer amputations. If the wound is large, it can be continued with Split-Thickness skin graft (STSGs).

**Case Report:** A-54-years-old male patient, moderately confirmed COVID 19 with diabetes Mellitus comorbidty and diabetic foot ulcer. Around the wound there was a black tissue the base of which were muscles and tendons. The tissue culture examination found hemolytic streptococcus bacteria. Diabetic ulcers are given antibiotic therapy, NPWT and STSG. After the patient had been discharged from the hospital and then examined by the surgical clinic, the wound was closed completely.

**Conclusion:** Diabetes is also a comorbid COVID-19 infection. Patients who are infected with COVID-19 and have uncontrolled blood sugar will prolong the treatment period for diabetic foot ulcers and can improve amputation therapy. Negative-Pressure Wound Therapy (NPWT) is a tool that is often and effective used for wound management.

**Keywords:** Covid, diabetic Foot, ulcer  
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## INTRODUCTION

Coronavirus disease 2019 (COVID-19) is an infection that causes severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The clinical manifestation in this disease such as fever, cough, and dyspnea can progress to pneumonia, acute respiratory distress syndrome, multiple organ failure, and death. Older COVID-19 patients with comorbidities, such as diabetes, were in a greater risk to poor outcome and death.<sup>1,2</sup>

Diabetes is one of leading causes for chronic disease and limb loss worldwide, currently affecting 382 million people. It is predicted that by 2035, the number of reported diabetes cases will soar to 592

million.<sup>3</sup> It is estimated that 19–34% of patients with diabetes are likely to be affected with a diabetic foot

ulcer in their lifetimes.<sup>4</sup> World Health Organization predicts that diabetes will be the seventh leading cause of death in 2030. A further effect of the explosive growth in diabetes worldwide has become one of the leading causes of limb loss. Every year, >1 million people with diabetes suffer limb loss as a result diabetes. It means every 20 seconds, an amputation occurs in the world as an outcome of this debilitating disease.<sup>5</sup>

Patients with diabetes are particularly susceptible to foot infection primarily because of diabetic neuropathy, peripheral artery disease, or both of them. Peripheral neuropathy occurs in about 30-50 percent of patients with diabetes. The manifestation such as losing the protective sensations for temperature and pain, impairs awareness of trauma such as abrasions, blistering, or penetrating foreign body. Local pressure in that skin is easy to cause skin ulceration and tissues are exposed to

colonization by pathogenic organism. The result is wound infection may begin superficially, but with delay in treatment and impaired body defense mechanisms caused by neutrophil dysfunction and vascular insufficiency, it can spread to the contiguous subcutaneous tissues and even deeper structures.<sup>6, 13,14</sup>

Diabetic foot ulcers are exacerbated by bacterial infections such as coagulase-positive *Staphylococcus aureus* (*S. aureus*) and also the emerging CoNS, including *Staphylococcus epidermidis* (*S. epidermidis*) and *S. haemolyticus*. *S. Haemolyticus* has the characteristic of being able to produce exopolysaccharides which can inhibit the growth of other bacteria and also decrease their ability to form biofilms. These bacteria also have good adaptability and cause antibiotic resistance.<sup>8</sup>

Assessment of vascular status can be discovered by the absence of foot pulses, reduced ankle brachial index (ABI) and duplex ultrasonography. While assessing neuropathy, touch, vibration, and pressure sensations should be checked routinely using cotton wool, tuning fork, and 10-g nylon monofilament, respectively. Plain radiography of the foot is indicated for detection of osteomyelitis, foreign bodies, or soft tissue gas.<sup>6, 13</sup>

Effective management of diabetic foot infection requires comprehensive therapy such as antibiotic therapy, surgical drainage, debridement and resection of dead tissue, appropriate wound care, and correction of metabolic abnormalities.<sup>6</sup>

## CASE PRESENTATION

A 54-years-old man with a diagnosis Post STSG cruris sinistra caused by ulcer DM cruris sinistra on NPWT, was moderately confirmed COVID, pulmonary TB/tuberculoma with TB pleuritis, type 2 diabetes, hyponatremia and anemia. The patient initially came to the ER. RSUI referred from Puskemas Ratu Jaya with complaints of weakness, coughing, shortness of speech and there had been a wet wound on the left leg for 1.5 months. The patient had diabetes mellitus and a history of pulmonary tuberculosis in 2007 and was declared cured by the doctor. The patient had a PCR checked in an outside laboratory and was diagnosed with COVID-19. The patient was treated for about 3 weeks in hospital.

On physical examination of the eyes were within normal condition, from lung examination, symmetrical chest expansion, rhonchi on the basal of the right and left lungs, examination of the heart and abdomen were within normal limits. On the patient's feet, there were 3 ulcers (holes). The first wound, 9.5 x 4.5 cm in size, was reddish and there was tissue necrosis around the wound. Wound II measuring 4x2 cm with a depth of approximately 1 cm reddish color. Wound III measures 4.5 x 3 cm deep down to the tendon, necrosis (+), pus (+). Three wounds were connected and deep. The skin looked hyperemic, tender and painful to touch. On the examination of the dorsalis pedis artery right and left +, crt was less than 2 seconds and warm.

At the support examination, a chest X-ray was performed, there was an impression of pneumonia, suspected tuberculosis and minimal effusion. An X-ray examination of left cruris

suggestive of picture, periostitis in the cortex of the left tibial diaphysis on the medial side, soft tissue edema with emphysema subcutis in the postero-medial region of the left cruris. In the laboratory examination, the impression of leukocytosis, hyponatremia, hyperglycemia, hypercoagulation and aerobic tissue culture examination was found *staphylococcus haemolyticus*, Gram examination was suggestive of infection and culture.

Treatment of the patient is planned to provide antiviral, post STSG left cruris, left cruris dm left cruris on NPWT diameter 12x8, pressure 100 mmhg continuous setting. FDC-OAT 1x3 tab, heparin 2x5000/sc. Tygacil, clindamycin, further amikacin. After STSG from the right thigh area and then attached to the left cruris followed by NPWT for 5 days, the amount of pus and seepage fluid was not there. After the NPWT is removed, it is closed with gauze and replaced in every 2 days.

After the patient has been discharged from the hospital, the patient returns to the surgical clinic to see the progress of wound care. After 4 examinations with the surgical clinic the wound was closed completely, and there were no signs of inflammation in this patient's wound. The patient was declared cured and did not need control again.



1.1 the patient's feet, there were 3 ulcers (holes).



1.2 left cruris on NPWT therapy



1.3 After therapy NPWT and STSG



1.4 After, control wound in surgical clinic

## DISCUSSION

Approximately, diabetes affects 442 millions people worldwide, 8.5% of the adult population. One of four people with diabetes will suffer a diabetic foot ulcer in their lifetime.

Diabetic foot ulcer is a frequent and severe complication in diabetics and become the most common cause of diabetes-associated hospitalization. Patients who have diabetic foot ulcers are predisposed to a large proportion of nontraumatic factor amputation. It is estimated that 85% of diabetic foot amputation is preceded by infection. Diabetic ulcer patients begin with peripheral neuropathy. A population-based cohort study in the United Kingdom demonstrated that the development of a DFU is associated with a 5% mortality in the first 12 months and a 42% mortality within 5 years.<sup>7, 11, 13</sup>

Several studies suggest that diabetes patients are at greater risk of COVID 19. Of the 41 patients with covid-19 on that journal. 32% had other diseases. Of these patients with other diseases, the three most common underlying conditions were diabetes (20%), hypertension (15%), and vascular disease (15%).<sup>13</sup>

Patients with covid-19 usually have hypercoagulability. Hyperglycemia condition that stimulates the coagulation factors then it interrupts blood flow to the ulcer. The effect prolongs inflammation and worsen the DFU outcome. Patients with diabetes are generally known to have an increased risk of infections due to an altered cytokine profile. T cell and macrophage activation with poor glycemic control further increasing the risk. The relationship of COVID-19 with diabetes has been extensively evaluated but its specific impact on the diabetic foot remains sparsely studied. Diabetic foot ulcers develop as a consequence of peripheral neuropathy, abnormal foot mechanics, peripheral artery disease and poor wound healing along with reduced blood flow secondary to peripheral arterial disease increasing the risk of secondary infection.<sup>12</sup>

In this patient, 3 wounds were found in the adjacent areas with different sizes. Around the wound there was a black tissue the base of which were muscles and tendons from the examination of the wound. This patient was debrided in the operating room and took tissue samples. The results of the tissue culture examination found hemolytic streptococcus bacteria. The therapy for this patient was also paired with NPWT, performed skin grafting and administration of antibiotics and drugs for the management of other diseases.

The wounds in this patient included ulcers. Based on the IWGDF ulcer, this patient was in the moderate category. Infections should be classified using the IDSA/IWInfections scheme as mild (superficial with minimal cellulitis), moderate (deeper or more extensive) or severe (accompanied by systemic signs of sepsis), as well as whether or not they are accompanied by osteomyelitis.<sup>13</sup>

Any overlying necrotic debris should be removed by scrubbing the wound with saline-moistened sterile gauze to eliminate surface contamination before an infected wound is cultured, any overlying necrotic debris should be removed by scrubbing the wound with saline-moistened sterile gauze to eliminate surface contamination. For wound culture, tissue specimens should be obtained by a biopsy of the wound or bone or by scraping the base of the ulcer with a scalpel or curette. The specimen should be processed for a Gram-stained smear, aerobic and anaerobic cultures.<sup>6</sup>

*Staphylococcus haemolyticus* (*S. Haemolyticus*) is one of the Coagulase-Negative-Staphylococci (CoNS) that inhabits the skin as a commensal. It causes an increasing risk in opportunistic infections, including diabetic foot ulcer (DFU) infections. Secreted enterotoxins can kill host cells and cause diseases by inducing different types of cell death, particularly apoptosis and necrosis. Diabetic foot ulcers with bacterial infection can prolong wound healing and can lead to systemic infection and death.<sup>8</sup>

From the another literature, patients with diabetic foot wound must have standard wound care include wound off-loading, local wound debridement, control of edema, control of bioburden, and wound moisture balance with appropriate dressings. Wound care evaluation minimum 4 weeks monitor, if DFUs that fail to improve (>50% area reduction), furthermore can be given wound therapy option. Adjunctive wound therapy options such as negative pressure therapy, biologics (PDGF, living cellular therapy, extracellular matrix products, amniotic membrane product), and hyperbaric oxygen therapy.<sup>5</sup>

Chronic diabetic foot wounds cannot be cured by heal progression standard wound. The suggested treatment is to use negative pressure wound therapy (NPWT). Negative-Pressure Wound Therapy (NPWT) is a tool that is often used for wound management. This tool uses an exudate suction system from the wound, reduces the frequency of dressing changes, keeps the anatomy of the wound clean and odorless. Based on theory, vacuum force aid in wound healing by increasing perfusion, extracting infectious material, and approximating wound edges. The reason to use this therapy causes a safer and effective treatment. A multicenter demonstrated NPWT to be as safe as and more

efficacious than advanced moist wound therapy (AMWT) for DFUs. The systematic review analyzing comparing NPWT with standard dressing changes show that NPWT has a higher rate of complete healing, shorter healing time, and few amputations.<sup>5, 9</sup>

Negative pressure over the diabetic wound bed allows the arterioles to dilate, thus increasing the effectiveness of local circulation, promoting angiogenesis, which assists in the proliferation of granulation tissue. Our data demonstrates that over the first 4 weeks of therapy, negative pressure wound dressings decrease the wound size more effectively than saline gauze dressings. It is suggested that NPWT is a cost-effective, preventing complications, easy to use and patient-friendly method of treating diabetic foot ulcers, and hence promising a better outcome.<sup>10</sup>

A superficial infection on the soft tissue can spread to the adjacent bone or marrow and cause osteomyelitis. Patients with a new diabetic foot infection and are suspects of osteomyelitis are suggested to have plain radiographs to evaluation bone abnormalities (deformity, destruction), soft tissue gas and radiopaque foreign bodies. When the soft tissue abscess is suspected or the diagnosis of osteomyelitis remains uncertain, the patients require additional imaging like MRI. The sensitivity and specificity of MRI for Diabetic for osteomyelitis were excellent (90% and 79%).<sup>5, 14</sup>

The secondary therapy to chronic diabetic foot ulcer is Split-Thickness skin graft (STSGs). from literature, they routinely use NPWT as an adjunct to prepare the wound bed before and to postoperatively bolster the STSG. According to this journal, mean time to complete wound healing 5.1 weeks with a range of 3-16 weeks.<sup>15, 16</sup> and from Ramanujam et al research, 83 patients used STSG, 54 (65%) healed uneventfully, 23 (28%) required re-grafting, and 6 (7%) had a complication resolved with conservative management.<sup>17</sup>

The need for more extensive amputation can be reduced by timely and aggressive surgical debridement or limited resection. Emergent surgery is required for a severe infection in an ischemic limb, necrotizing fasciitis, gas gangrene, and an infection associated with compartment syndromes. Surgical excision of affected bones has historically been the standard of care in patients with osteomyelitis. The wound may also be treated surgically with a flap or graft, left to heal by secondary intention, or managed with negative pressure dressings.<sup>6</sup>

## CONCLUSION

Patients who have diabetes have a risk of developing a diabetic foot ulcer disease. Diabetes is also a comorbid of COVID-19 infection. Patients who are infected with COVID-19 and have uncontrolled blood sugar will prolong the treatment for diabetic foot ulcers and can increase amputation therapy. Diabetic foot ulcers with bacterial infection can prolong wound healing and can lead to a systemic infection and death. Negative-Pressure Wound Therapy (NPWT) is a tool that is often and effective used for wound management.

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