DOI: 10.7860/JCDR/2023/63969.18347

Case Report

Surgery Section

# Utility of Phlebotomy Tourniquet as a Cost-effective Adjuvant in Diabetic Wound Closure: A Case Report

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## ABSTRACT

Diabetes Mellitus (DM) is associated with numerous complications, including cardiovascular diseases, blindness, renal failure, and foot ulcers, which can result in morbidity, amputation, and increased mortality rates. Present case is of a 50-year-old patient with a Diabetic Foot Ulcer (DFU) who underwent amputation of the 2nd, 3rd, and 4th toes of the right foot and was managed on an outpatient basis. A phlebotomy tourniquet was tied across the wound and gradually tightened to approximate the wound edges, facilitating wound contraction. After 45 days of treatment, the wound had fully healed. This case suggests that using a phlebotomy tourniquet can effectively close wounds when other techniques, such as skin grafting, are not feasible.


**Keywords:** Diabetic foot, Diabetes complication, Wound closure techniques

## CASE REPORT

A 50-year-old patient with a 10-year history of poorly controlled DM on insulin underwent Ray's amputation and debridement of the 3rd toe, 14 days after presenting with an acute DFU. However, after the surgery, the wound displayed dusky edges and necrotic tissue at its base [Table/Fig-1]. A digital angiography examination revealed the presence of a plaque in the middle section of the Superficial Femoral Artery (SFA), causing 50% stenosis. Additionally, multiple tandem plaques and occlusions were observed in the Anterior Tibial Artery (ATA), with very poor distal runoff in the Dorsalis Pedis Artery (DPA). There was a near-complete occlusion of the proximal and middle sections of the Posterior Tibial Artery (PTA), with very poor flow observed in the distal PTA. Significant stenosis was also noted in the peroneal artery. The SFA lesion was treated using a 5×40 mm balloon (Bard, Ultraverse). Attempts were made to treat the lesions in the ATA and PTA but were unsuccessful. Angioplasty of the peroneal artery was performed using a 2×100 mm balloon (Bard, Ultraverse). Following the angioplasty procedure, improved blood flow was observed in the DPA through the peroneal artery, as well as in the plantar arch through the peroneal artery and the DPA.

**[Table/Fig-1]:** Right foot showing Ray's amputation of the 3rd toe with a wound showing dusky edges and necrotic tissue at its base.

The treating surgeon recommended further debridement following angiography and angioplasty, leading to the patient being transferred to our centre. After the angioplasty, the 2nd and 4th toes displayed gangrenous changes, and the patient was advised to undergo Ray's or Trans Meta Tarsal (TMT) amputation to prevent an unstable foot. However, the patient declined and requested the removal of only the gangrenous 2nd and 4th toes. The patient was then managed on an outpatient basis with regular dressings. After the second surgery, the wound was large but displayed healthy granulation at its base [Table/Fig-2]. The challenge then arose: how to approximate the edges of this wide wound. Initially, skin grafting was considered a possibility, but it was determined that it would not be able to withstand the pressure on the sole. As such, an innovative approach was taken and decided to approximate the wound edges using a phlebotomy tourniquet [Table/Fig-3].

The use of the tourniquet allowed for a gradual tightening of the wound edges with each dressing, bringing them closer together over time. After 45 days of this treatment, the wound edges had completely approximated, and the wound had fully healed [Table/Fig-4]. X-ray of the patient showed amputated bones without any underlying osteomyelitis [Table/Fig-5]. This case demonstrates the potential utility of using a phlebotomy tourniquet in wound closure, particularly in situations where traditional methods such as skin grafting may not be feasible.

**[Table/Fig-2]:** Healthy granulation tissue.

**[Table/Fig-3]:** Novel use of a phlebotomy tourniquet for approximating wound edges.

**[Table/Fig-4]:** Healing progress of the wound.


**[Table/Fig-5]:** X-ray (Anteroposterior and Lateral view) of the healed foot, without any evidence of underlying osteomyelitis.

## DISCUSSION

Wound development, particularly DFUs, is a prevalent complication of DM that can result in physical disability and emotional distress in patients. DM contributes to the formation of DFUs through various mechanisms. It affects approximately 40-60 million people with diabetes worldwide [1] and is characterised by chronic wound formation that combines metabolic disturbances, nerve damage, hypoperfusion, and altered biomechanics of the lower extremities [2]. The primary cause of ulcers is typically the absence of pain due to neuropathy [3]. Conversely, neuropathy itself renders the skin of the foot dry and fragile, enhancing its proneness to cracking. DFUs significantly impact the quality of life and are associated with a wide range of mortality and morbidity. Moreover, serious complications such as infection, sepsis, and amputation may arise from DFUs [4]. Routine care has been demonstrated to produce only gradual improvements in the wound healing process.

Currently, treatments for managing DFUs include debridement, pressure relief ("off-loading"), antibiotics, revascularisation, Vacuum-Assisted Closure (VAC) therapy, secondary suturing, stapling, and skin adhesive glues [5]. The development of a successful clinical treatment for DFUs remains a challenge for the scientific community. Although a multitude of treatments is currently being used in the management of DFUs, their affordability remains a barrier to their use, particularly in low- and middle-income economies [6]. Present study used the method of phlebotomy tourniquet, which has a ubiquitous presence in the medical care setting, makes the treatment almost cost-free. Furthermore, most treatment modalities such as secondary suturing, stapling, and skin adhesive glues are effective for minor wounds, making them unsuitable for a large wound as in present case. VAC was not considered due to its unavailability and the longer recovery time period.

Despite numerous modalities of treatment being available, authors chose to use their novel method of wound approximation, considering the health and economic burden to the patient, as well as the limited availability of treatments. The centre had limited resources and the patient was from an economically disadvantaged background, demanding faster rehabilitation due to economic considerations. After ruling out other modalities of treating such a large wound and considering the economic limitations of the patient, authors opted for the approximation of the wound via this innovative approach.

The use of a tourniquet, as demonstrated in this case, may be a valuable tool in treating DFUs, particularly in low-income countries where access to advanced technologies may be limited. The tourniquet allows for a gradual approximation of the wound edges, bringing them closer together over time and ultimately leading to complete wound healing. The use of a tourniquet may be more cost-effective than other methods of wound closure, making it an attractive option for low-income countries where resources may be scarce. Additionally, the rehabilitation and healing in this patient were achieved fairly early compared to other modalities, although a detailed study with a larger sample size is required to comment on the efficacy of this principle. A thorough search of available literature revealed a lack of similar reports where a tourniquet was used for the approximation of a large wound. This signifies the novelty of the method and emphasises the need for further research regarding this technique.

## CONCLUSION(S)

Overall, the tourniquet appears to be a useful and practical tool in the treatment of DFUs and may provide an alternative for clinicians in resource-limited settings. Further research is needed to fully understand the potential benefits and limitations of this approach and to determine its place in the treatment algorithm for DFUs or any wound that requires gradual approximation.

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**PLAGIARISM CHECKING METHODS:** [Jain H et al.]
- Plagiarism X-checker: Mar 15, 2023
- Manual Googling: Apr 13, 2023
- iThenticate Software: May 19, 2023 (8%)

**ETYMOLOGY:** Author Origin

**EMENDATIONS:** 6

**AUTHOR DECLARATION:**
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Mar 09, 2023**
Date of Peer Review: **May 06, 2023**
Date of Acceptance: **May 30, 2023**
Date of Publishing: **Aug 01, 2023**