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Case Report

Rapid healing of a delayed post amputation wound secondary to femoral artery thrombosis

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ABSTRACT

Post-amputation wound complications are a known problem for people with peripheral arterial disease. The risk is much higher for people who have immunosuppression or metabolic problems. When femoral artery thrombosis affects tissue perfusion, the body's natural processes for healing wounds are greatly weakened, making patients more likely to get a secondary infection and have long-lasting health problems. We present the case of a 56-year-old man with a constellation of systemic comorbidities type 2 diabetes mellitus, HIV infection, hypertension, and malnutrition who underwent right below-knee amputation following CT angiography-confirmed femoral artery thrombosis. Despite standard wound care and systemic antibiotics, the postoperative wound demonstrated persistent delayed healing, characterized by slough formation, active infection, moderate-to-high exudate levels, and significant pain. A structured collagen-based wound care protocol was introduced, utilizing a combination of QuoroGel®, QuoroFiber, and QuoroHeal as primary dressing agents, applied at three-day intervals over a 15-day treatment course. No adjunctive interventions such as offloading, compression therapy, or advanced supportive modalities were employed. Clinically meaningful improvement was evident after the very first dressing application. Progressive development of healthy granulation tissue was noted by the second and third dressings, with epithelialization becoming apparent after the fourth. The wound responded well in terms of infection control and pain relief, with no treatment-related adverse events recorded throughout the observation period. In this patient with increased risk factors and impaired wound healing because of immunosuppression and malnutrition, it has been shown that collagen dressing can help to accelerate wound healing. It is possible that the benefit provided by collagen dressing could be proven through further controlled studies.

Keywords: Wound, Collagen dressing, Below-knee amputation, Split-thickness skin grafting

INTRODUCTION

The peripheral arterial disease (PAD) is a progressive illness caused by atherosclerosis, where the insufficient arterial supply of blood leads to hypoxia of tissues and inability of wound healing. Critical limb ischemia (CLI), the latest form of PAD, is a state in which the extent of the disease causes the emergence of rest pain, ulceration, or gangrene in patients. CLI is the ultimate stage of PAD and one of the major reasons for leg amputation in the world.[1,2] The study of the affected limbs in histopathology shows that there is macrovascular occlusion, disturbance of the microcirculation system, and low levels of tissue oxygenation, which are the reasons why even small injuries may become dangerous infections or lead to necrosis.[2]

While amputation effectively removes non-viable tissue and addresses systemic sepsis, stump healing in ischemic patients is far from guaranteed. Below-knee amputation (BKA) in the context of CLTI is frequently complicated by postoperative wound failure, contributing disproportionately to patient morbidity and healthcare resource burden. Residual perfusion insufficiency at the stump level increases the risk of delayed granulation, wound dehiscence, infection, and graft non-integration, which makes postoperative wound management in this population difficult.[3]

Systemic comorbidities add even more problems to an already fragile healing environment. Diabetes mellitus disrupts virtually every phase of wound repair: it perpetuates the inflammatory response, interferes with angiogenesis, skews macrophage polarization, and diminishes fibroblast activity collectively fostering conditions conducive to chronic, non-healing wounds.[4,5] Hyperglycemia-driven oxidative stress and heightened infection susceptibility further erode the already compromised healing potential. In patients with HIV infection, especially those with $CD4^+$ T-cell depletion, pathogen clearance is reduced, biofilm formation is more prevalent, and the wound-healing timeline is markedly extended.[6] Malnutrition compounds these effects by restricting the substrate availability necessary for collagen synthesis, cellular proliferation, and immunological defense, substantially amplifying the risk of wound chronicity following amputation.[5,6]

Because of this multifactorial burden, standard wound care methods often don't work well for people with severe ischemia or a weakened immune system. As a result, modern wound care has moved away from just covering the wound and toward actively changing the wound microenvironment. Collagen-based dressings serve as biomimetic extracellular matrix (ECM) scaffolds, aiding in the recruitment of fibroblasts and keratinocytes, enhancing neovascularization, and mitigating the heightened protease activity associated with chronic wounds.[7] A meta-analysis synthesizing data from 11 randomized controlled trials with 961 participants indicated that collagen dressings attained complete wound closure at markedly higher rates compared to standard care (53.4% vs. 34.5%).[8] Nair HKR et al concluded in a case series of hard-to-heal chronic wounds that QuoroGel shows beneficial progress in such cases. TIME was used to evaluate the progression of the wound bed. Early granulation & progressive wound size reduction within 2-3 weeks on QuoroGel.[9]

Even though there is some proof, there isn't much information about ECM-modulating strategies in ischemic post-amputation wounds, especially in diabetic and immunocompromised patients who can't have their blood flow restored. This case report describes a situation where a patient healed faster than expected, looking into the possible clinical benefits of using collagen-based wound care when traditional methods didn't work

CASE REPORT

A 56-year-old male presented with a progressive history of right-leg claudication and distal limb discoloration. The authors obtained informed consent from the patient during treatment. Vascular assessment, including Doppler ultrasonography and CT angiography of the lower extremity (Figure 1), revealed significant occlusion within the right femoral arterial system. These findings, in conjunction with the clinical presentation, supported a diagnosis of right femoral artery thrombosis (Table 1).

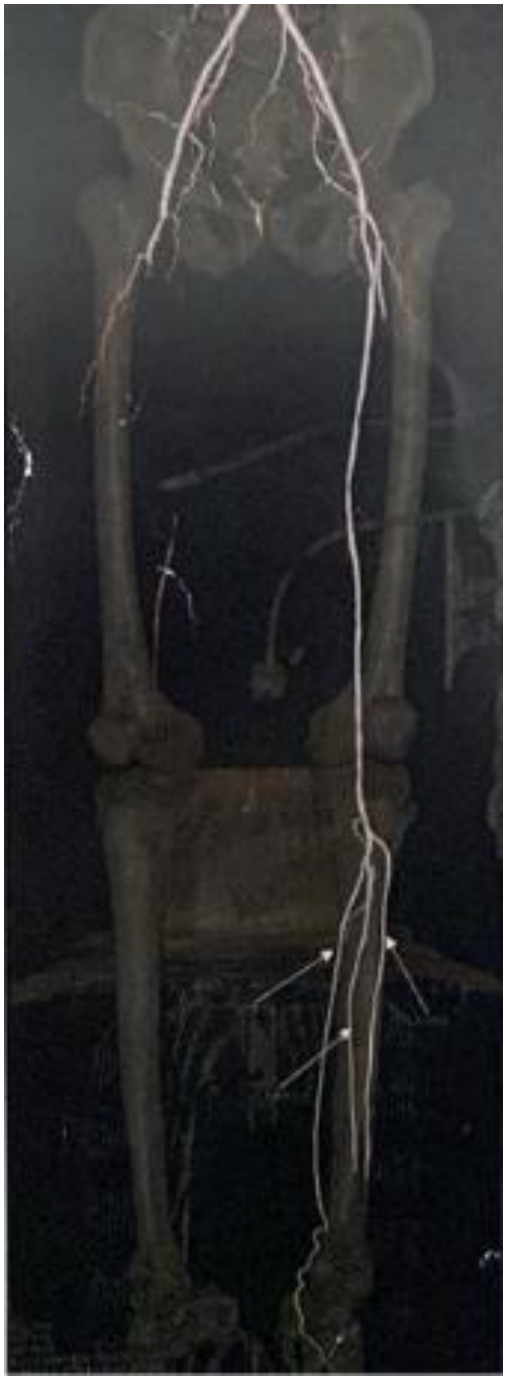

Figure 1: CT Angiography of the bilateral lower limb arterial system.

Table 1: Laboratory parameters on admission.

Laboratory value during hospitalization			
Parameter	Result	Unit	Normal
Hemoglobin	11.1	gm/dl	13 to 17
RBC	3.58	Millions/cmm	4.5 to 5.5
WBC	5940	/cmm	4000 to 10000
Platelet count	125000	/ul	150000 to 410000
SGPT	85	U/l	0 to 55
SGOT	141	U/l	5 to 34
HIV++			
HIV 1 & 2 (By CMIA) 101.68 Reactive, HIV (By immunoassay) Reactive, HIV Immunochromatography Reactive.			
RBS: -226 mg/dl			
ABG [pH 7.392] [PO2 45.6] [PCO2 39.9mmHg]			

In view of the non-viable limb and the extent of ischemic damage, a right above-knee (AK) amputation was performed at Civil Hospital, Ahmedabad, with primary wound closure. The immediate postoperative course was uncomplicated, and the patient was discharged to his home in Surat, Gujarat. Approximately one-week post-discharge, the patient developed foul-smelling purulent discharge and evidence of wound breakdown at the amputation site. He was assessed by an Orthopedic Surgeon, who identified progressive infection threatening the residual limb. A guillotine amputation of the right lower limb was performed as an emergency measure to achieve rapid source control and salvage the remaining viable tissue. Following the second amputation, wound closure was attempted via split-thickness skin grafting (STSG) on two separate occasions; however, each procedure resulted in only approximately 50% graft take, indicating partial graft failure on both attempts (Figure 2).

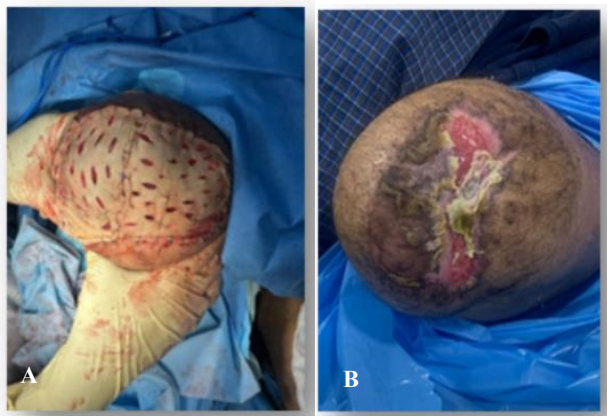

Figure 2 (A and B): Pre-intervention wound status and partial skin graft failure.

The patient was enrolled in a structured wound management protocol using the Quorit advanced wound care system. QuoroGel® a formulation incorporating collagen, vitamin C, and nano-silver was combined with QuoroFiber (collagen-based fibrous particles) in a 1:1 ratio to form a uniform paste. The goal of putting this mixture on the whole wound bed as a thick, even layer was to provide extracellular matrix scaffolding, antimicrobial coverage, and moisture control. The main dressing layer was a sterile gauze dressing that went over the paste. Every 3 to 4 days, the dressing was changed, but the frequency depended on the amount of exudate and the clinical status of the wound. The patient was given QuoroHeal tablets twice a day for 10 days as an additional treatment to help the body heal itself better.

Outcome and follow-up

Following surgical debridement and saline irrigation of the wound, the 1:1 QuoroGel®: QuoroFiber paste was applied across the full extent of the wound bed. The clinical progression across dressing changes was as follows (Figure 3 and 4).

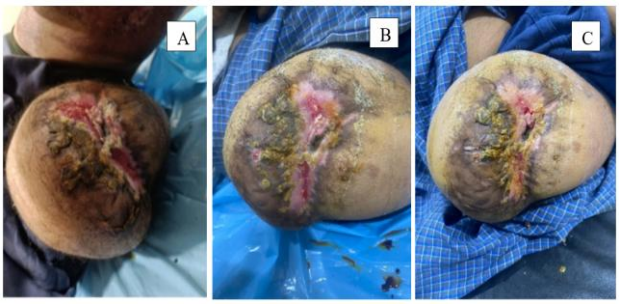

Figure 3: (A) After 1st dressing, Autolytic debridement was initiated and early tissue granulation became apparent. (B) After 2nd dressing, the granulating tissue displayed a healthy pinkish coloration, indicating active vascular ingrowth. (C) After 3rd dressing, the wound edge convergence toward the center was visibly progressing.

The patient was subsequently advised to continue applying QuoroGel® once daily as a maintenance measure until complete wound closure. At one-month follow-up, the wound had healed satisfactorily.

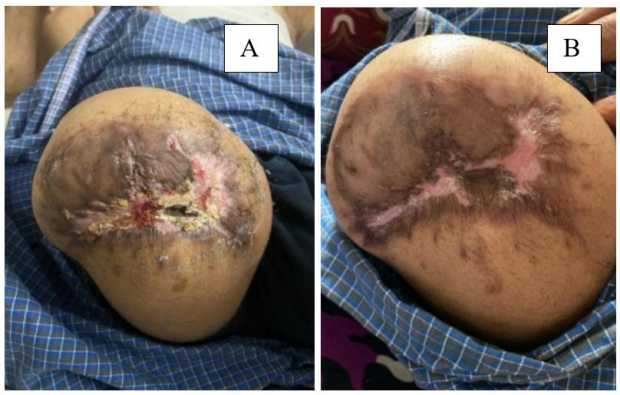

Figure 4: (A) After the 4th dressing, approximately 80% wound closure had been achieved and (B) after recovery.

DISCUSSION

CLTI represents the most advanced stage of peripheral arterial disease, where chronic ischaemia and microvascular dysfunction significantly impair wound healing. Persistent tissue hypoxia and poor stump perfusion have been shown to delay granulation and predispose to dehiscence, infection, and graft failure.[1-3] In our patient, healing was further impeded by multiple systemic risk factors such as diabetes, HIV-associated immunosuppression, anaemia, and malnutrition each well-known to disrupt the normal repair cascade.

Diabetes prolongs the inflammatory phase of wound healing and impairs angiogenesis, fibroblast function and collagen synthesis, thereby delaying tissue repair. HIV-associated immune dysfunction further compromises host defence, increasing susceptibility to persistent infection and biofilm formation, which can impede wound closure. Previous studies have similarly demonstrated that diabetes and immunosuppression are independently associated with delayed healing, higher infection rates, and poor graft outcomes, particularly in patients with chronic or ischemic wounds.[4,6,9,10] The coexistence of these conditions in our patient likely contributed to the persistent wound infection and repeated partial graft failure following two STSG procedures.

Collagen-based wound therapies are increasingly used in chronic, hard-to-heal wounds because they actively reshape the wound microenvironment rather than just covering the defect. Exogenous collagen provides a biomimetic extracellular matrix scaffold, dampens excessive protease activity, and supports fibroblast migration, keratinocyte proliferation, and angiogenesis. These mechanisms are well supported by experimental and clinical evidence. In fact, systematic reviews and clinical trials have demonstrated that collagen dressings significantly accelerate healing of chronic wounds and improve wound bed preparation compared with standard dressings.[7,8,11,12]

In the present case, the combined application of QuoroGel® and QuoroFiber created a collagen-rich wound environment that appeared to support progressive tissue regeneration. The vitamin C component of QuoroGel® may have enhanced collagen synthesis and stabilization through its role in collagen hydroxylation, while nano-silver likely contributed to infection control by reducing bacterial load and disrupting biofilm formation. These findings are consistent with the case series reported by Nair et al who demonstrated successful wound bed preparation, healthy granulation tissue formation, and progressive healing with QuoroGel in hard-to-heal wounds. Similarly, systematic evidence by Shu et al. showed that collagen dressings improve wound healing outcomes compared with conventional dressings, supporting the role of collagen-based extracellular matrix therapy in chronic wound management.[8] The favourable clinical response observed in our patient suggests that the combined use of QuoroGel® and QuoroFiber may have helped overcome the hostile wound environment associated with ischemia and immune compromise by promoting tissue regeneration while reducing local bioburden.

This report is limited by its single-patient design. Although our favourable outcome mirrors other reports of success with collagen-based dressings, it cannot be generalized without caution. As Nair et al themselves acknowledge, their case series lacked controls and had a small sample size, and they call for prospective trials to validate these findings. In summary, while our case provides encouraging evidence that combined collagen-based therapy may benefit difficult post-amputation wounds, larger controlled studies in diabetic and immunocompromised populations are needed before definitive conclusions can be drawn.

CONCLUSION

The current case study highlights the intricacies of wound healing in a CLTI patient who suffers from several co-morbid medical conditions, such as diabetes and HIV infection. The combination of chronic ischemia, compromised immunity, and nutrition deficiency has led to a situation where standard wound management practices were not effective in achieving full recovery; therefore, two surgeries involving skin grafts did not yield the desired results. The employment of QuoroGel® and QuoroFiber for wound management allowed for the creation of a favorable environment promoting wound bed preparation and tissue regeneration due to ECM contribution and antiseptic properties. Even though the patient presented many risks to his healing process, wound healing progress was noticeable during each stage of the treatment process. Although a case study provides limited data for further analysis, it seems that ECM treatment using collagen products can offer clinicians another alternative when other wound treatment strategies prove to be ineffective.

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REFERENCES

1. Nishio Y, Tsuji Y, Kitano I, Terashi H. Influence of peripheral arterial disease on wound healing in heel pressure ulcers. Kobe J Med Sci. 2022;67(4):E146-54.
2. Narula N, Dannenberg AJ, Olin JW, Bhatt DL, Johnson KW, Nadkarni G, et al. Pathology of peripheral artery disease in patients with critical limb ischemia. J Am Coll Cardiol. 2018;72(18):2152-63.
3. Virolainen M, Bako E, Kallio M, Nuutinen H, Halonen J, Karjalainen J, et al. Surgical wound complications after major lower limb amputations for chronic limb-threatening ischemia. J Vasc Surg. 2026;83(1):172-80.e8.
4. Dasari N, Jiang A, Skochdopole A, Chung J, Reece EM, Vorstenbosch J, et al. Updates in diabetic wound healing, inflammation, and scarring. Semin Plast Surg. 2021;35(3):153-8.
5. Spampinato SF, Caruso GI, De Pasquale R, Sortino MA, Merlo S. The treatment of impaired wound healing in diabetes: looking among old drugs. Pharmaceuticals (Basel). 2020;13(4):60.
6. Weledji EP, Kamga HLF, Assob JC, Nsagha DS. A critical review on HIV/AIDS and wound care. Afr J Clin Exp Microbiol. 2012;13(2):66-73.
7. Alberts A, Bratu AG, Niculescu AG, Grumezescu AM. Collagen-based wound dressings: innovations, mechanisms, and clinical applications. Gels. 2025;11(4):271.
8. Shu H, Xia Z, Qin X, Wang X, Lu W, Luo Q, et al. The clinical efficacy of collagen dressing on chronic wounds: a meta-analysis of 11 randomized controlled trials. Front Surg. 2022;9:978407.
9. Nair HKR, Ampalakam SV, Ngiu R, Abdul Khalib MA. A case series of QuoroGel as a primary wound dressing for the treatment of hard-to-heal wounds. Wounds APAC. 2024;7(2):28-32.
10. Armstrong DG, Boulton AJM, Bus SA. Diabetic foot ulcers and their recurrence. N Engl J Med. 2017;376(24):2367-75.
11. Guo S, DiPietro LA. Factors affecting wound healing. J Dent Res. 2010;89(3):219-29.
12. Gould LJ. Topical collagen-based biomaterials for chronic wounds: rationale and clinical application. Adv Wound Care (New Rochelle). 2016;5(1):19-31.

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