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Case Report

Negative Pressure Wound Therapy and Staged Debridement for Infected Bilateral Above-knee Amputation Stump Ulcers: A Case Report

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Abstract

Bilateral above-knee amputation stump ulcers with poor arterial inflow, multidrug-resistant infection, and bone involvement are rare and difficult to manage. We report a 52-year-old man who developed nonhealing bilateral stump ulcers more than one month after emergency bilateral amputation for extensive aortoiliac and lower-extremity arterial thrombosis. On admission on January 6, 2026, the right stump wound measured approximately 16.0 × 13.0 cm, with exposed femoral bone, purulent medullary drainage, and necrotic tissue; the left measured 18.0 × 12.0 cm, with slough and persistent exudation. Wound culture yielded carbapenem-resistant *Klebsiella pneumoniae*, and right femoral bone pathology supported chronic necrotizing osteomyelitis. Because immediate revascularization was not feasible, we used a staged debridement strategy—repeated selective debridement preserving viable tissue, with negative pressure wound therapy (NPWT) as a bridge between operations—combined with delayed stump repair, culture-guided antimicrobial therapy, anticoagulation, analgesia, vascular protection, and nutritional support. NPWT was applied in seven cycles over approximately 54 days. The wounds achieved complete closure by discharge on March 16, 2026. At follow-up on March 30, 2026, there was no exudation, sinus tract, recurrent dehiscence, exposed bone, recurrent infection, or significant stump pain, although prosthetic fitting was not yet possible. This case suggests that NPWT combined with serial staged debridement may offer short-term salvage for selected complex infected amputation stumps when arterial inflow is poor and one-stage closure is unsafe; however, durability and generalizability remain uncertain.

Introduction

Infected amputation stump ulcers remain a difficult wound-care problem, particularly when they occur with severe arterial insufficiency, wound dehiscence, exposed bone, or deep soft-tissue infection. In such patients, treatment must address not only the local wound bed but also the vascular background, microbial burden, nutritional condition, pain, anticoagulation status, and rehabilitation trajectory.[1-3] Negative pressure wound therapy (NPWT) is widely used to remove exudate, reduce edema, stabilize the wound environment, and support granulation tissue formation after adequate debridement.[4-7] However, evidence remains limited for bilateral high-level amputation stumps complicated by poor inflow, carbapenem-resistant *Klebsiella pneumoniae* (CRKP) infection, and chronic osteomyelitis. The novelty of the present case is therefore not the use of NPWT itself, but the combined use of staged debridement, repeated wound-bed preparation, and NPWT in a rare bilateral above-knee stump case with severe vascular compromise and deep infection.

In this report, we describe a patient with infected bilateral above-knee amputation stump ulcers treated with NPWT, serial staged debridement, and delayed stump repair. The report emphasizes measurable wound changes, antimicrobial management, vascular constraints, and follow-up outcomes.

Case presentation

A 52-year-old man was admitted on January 6, 2026, because of bilateral nonhealing above-knee amputation stump wounds that had persisted for more than one month. More than one month

Keywords: Amputation stump ulcer; Negative pressure wound therapy; Staged debridement; Poor arterial inflow; Carbapenem-resistant *Klebsiella pneumoniae*; Osteomyelitis; Wound-bed preparation.

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Fig. 1. Baseline appearance of the bilateral above-knee amputation stump ulcers at admission. (a) Right stump with exposed bone and extensive necrotic tissue. (b) Left stump with slough, tissue loss, and a persistent exudative wound bed. All identifying information in the images has been obscured or removed. The photographs were taken at admission on January 6, 2026.

before admission, he had been hospitalized elsewhere for aortic, iliac, and lower-extremity arterial thrombosis with ischemic gangrene. He underwent emergency aortic thrombectomy, iliac thrombectomy, aortic balloon dilation, percutaneous lower-extremity thrombectomy, lower-extremity balloon dilation, aortography, and sequential right and left above-knee amputation. Postoperatively, the stump wounds developed drainage and dehiscence. Conventional dressing changes failed to achieve healing, and the patient was treated at different institutions before referral to our hospital.

Personal history, including smoking, alcohol consumption, and exposure to epidemic areas, was not completely documented in the available transferred records. Before admission to our department, previous anti-infective and anticoagulant medication details from outside institutions were also incomplete; therefore, the antimicrobial course reported below refers to the verified inpatient records at our hospital. The patient was alert, had full capacity to provide consent, and personally provided written informed consent for publication of the de-identified clinical details and images.

On admission, the patient was alert and hemodynamically stable, with a temperature of 36.6 °C, pulse of 78 beats/min, respiratory rate of 18 breaths/min, and blood pressure of 128/76 mmHg. Both above-knee stumps were open. The right stump wound measured approximately 16.0 × 13.0 cm and showed exposed femoral stump bone with yellowish discoloration, pulse-like purulent drainage from the medullary cavity, abundant attached necrotic fascia-like tissue, local scarring, and marked tenderness. The left stump wound measured approximately 18.0 × 12.0 cm and showed a dark-red wound bed, necrotic slough, and serous exudate. A postoperative ulcer measuring approximately 6.5 × 4.0 cm was present in the right groin region (Fig. 1).

Laboratory testing on January 6, 2026, showed anemia and evidence of inflammatory activity and poor nutritional reserve: hemoglobin 85.0 g/L, white blood cell count 5.86×10^9/L, C-reactive protein 12.53 mg/L, serum amyloid A 54.9 mg/L, procalcitonin 0.23 ng/mL, total protein 60.6 g/L, and prealbumin 102.9 mg/L. Wound secretion culture grew CRKP, while bone pathology confirmed chronic necrotizing osteomyelitis; bone culture was not available, and therefore CRKP could not be confirmed as the causative pathogen of the osteomyelitis. These findings confirmed deep infection with bone involvement rather than superficial postoperative dehiscence alone (Table 1). Key clinical features and management details are summarized in Table 2.

Vascular information from pre-referral computed tomography angiography and angiographic assessment documented bilateral common and external iliac artery occlusion, femoral artery occlusion, moderate stenosis of the abdominal aortic lumen, and near-proximal occlusion of the superior mesenteric artery. No ankle-brachial index, transcutaneous oxygen pressure, or formal skin perfusion pressure result was available in the records. Vascular surgical evaluation considered immediate revascularization unsuitable because of extensive multilevel occlusion, poor outflow conditions, severe systemic arterial disease, and active bilateral stump infection. Conservative vascular-protective management and staged wound control were therefore selected.

A staged salvage strategy was selected because immediate definitive revascularization was not feasible and simple wound care had failed. On January 8, 2026, the first major debridement was performed. Necrotic fascia-like tissue and nonviable soft tissue were excised from both stumps, purulent material was cleared from the right medullary cavity, and the wounds were thoroughly irrigated. Infected and necrotic bone was managed surgically; the medullary cavity was cleared, and the femoral stump was re-cut proximally using a wire saw when required. Bone edge status was assessed intraoperatively. No bone tissue culture was available.

NPWT was applied using black polyurethane foam. In the early operations, the exposed bone and medullary cavity were filled with black foam for negative-pressure drainage after surgical clearance. Continuous negative pressure was used, generally

Table 1. Key laboratory, microbiological, and pathological findings at admission

Parameter	Result	Reference range	Clinical interpretation
White blood cell count	5.86×10^9/L	$3.50\text{-}9.50 \times 10^9$/L	Within reference range
Neutrophil percentage	73.70%	40.0-75.0%	Upper-normal
Lymphocyte percentage	11.10%	20.0-50.0%	Decreased
Hemoglobin	85.0 g/L	130.0-175.0 g/L	Anemia
Platelet count	223×10^9/L	$125\text{-}350 \times 10^9$/L	Within reference range
C-reactive protein	12.53 mg/L	0-10.0 mg/L	Mildly elevated
Serum amyloid A	54.9 mg/L	0-6.4 mg/L	Elevated
Procalcitonin	0.23 ng/mL	0-0.05 ng/mL	Elevated
Interleukin-6	<1.50 pg/mL	0-7.0 pg/mL	Not elevated
Total protein	60.6 g/L	66.0-83.0 g/L	Decreased
Albumin	37.1 g/L	35.0-52.0 g/L	Within reference range
Prealbumin	102.9 mg/L	120.0-250.0 mg/L	Decreased
Creatinine	64.3 μmol/L	57.0-111.0 μmol/L	Within reference range
Wound secretion culture	CRKP	-	Multidrug-resistant organism
Bone pathology (right stump)	Chronic necrotizing osteomyelitis	-	Bone involvement confirmed

CRKP, carbapenem-resistant *Klebsiella pneumoniae*.

maintained between −200 and −100 mmHg according to wound drainage, sealing stability, and patient tolerance. NPWT was performed in seven documented cycles on January 8, January 13, January 20, February 2, February 13, February 25, and March 4, 2026, with a total treatment duration of approximately 54 days. Dressing change intervals were adjusted according to exudate volume, wound status, and operative planning. Early pain was prominent but improved after intraoperative re-management of the sciatic nerve. No major NPWT-related hemorrhage, uncontrollable leak, or clinically significant tube obstruction was recorded. The pressure range was chosen because arterial inflow was severely compromised and the patient was receiving anticoagulation: treatment was initiated at the higher end (approximately −200 mmHg) to control heavy exudation and was gradually reduced toward −100 mmHg when pain occurred or when bleeding or ischemia was a concern. The foam was trimmed to avoid direct pressure on exposed bone edges and neurovascular structures, and the periwound skin was protected with a barrier film before sealing.

Repeat operations were performed according to wound status. On January 13, a second debridement and stump repair procedure was undertaken after removal of NPWT dressings, with additional excision of residual necrotic tissue and partial layered closure where feasible. Additional staged repair procedures were performed on February 2, February 13, February 25, and March 4, 2026. At each session, the wound cavity was reassessed, residual necrotic tissue was removed, wound edges were refreshed when appropriate, partial closure was advanced when local conditions permitted, and NPWT was reapplied to bridge the interval between procedures (Table 3).

Systemic antimicrobial treatment was documented as follows: cefoxitin 1 g twice daily plus levofloxacin 500 mg once daily from January 8 to January 12; levo-ornidazole phosphate 1,000 mg once daily plus ceftazidime-avibactam 2.5 g twice daily from January 13 to January 19; no antimicrobial therapy was documented from January 20 to February 1; levo-ornidazole phosphate 1,000 mg once daily plus ceftazidime 1 g twice daily from February 2 to February 9; and ceftazidime-avibactam 2.5 g twice daily from February 9 to March 9 (Table 4). Serum creatinine was 64.3 μmol/L on admission, within the reference range; treatment-period CrCl/eGFR data were not available in the verified records. The twice-daily ceftazidime-avibactam schedule was used according to the institutional protocol for localized CRKP wound infection undergoing repeated surgical source control, following infectious disease and clinical pharmacy consultation. The verified intravenous antimicrobial treatment period extended from January 8 to March 9, 2026, but administration was intermittent because no antimicrobial therapy was documented from January 20 to February 1; ceftazidime-avibactam was discontinued on March 9 after adequate surgical source control had been achieved and stump edema, exudation, and inflammatory indicators had improved, and no oral or intravenous antibiotics were continued after discharge on March 16 or at the follow-up on March 30. A culture on February 25 grew Corynebacterium striatum from the wound; because the wound bed was clinically improving, this was interpreted as colonization or secondary surface flora rather than uncontrolled CRKP infection, and the antimicrobial regimen was not changed. Supportive treatment included analgesia, anticoagulation and vascular-protective management, nutritional support, and close monitoring of drainage, wound-edge viability, and recurrent infection.

During hospitalization, no overwhelming systemic septic deterioration was documented. Serial procedures gradually reduced the wound bioburden and prepared the stump beds for

Table 2. Summary of key clinical features and management details

Item	Clinical details
Admission wound size	Right stump: approximately 16.0 × 13.0 cm; left stump: approximately 18.0 × 12.0 cm; right groin: 6.5 × 4.0 cm
Vascular assessment	CTA/angiography: bilateral common/external iliac artery occlusion, femoral artery occlusion, moderate abdominal aortic stenosis, near-proximal superior mesenteric artery occlusion
Reason revascularization was not feasible	Extensive multilevel occlusion, poor outflow, severe systemic arterial disease and active bilateral stump infection
Microbiology	Initial wound secretion: CRKP; February 25 culture: *Corynebacterium striatum*, interpreted clinically as colonization/surface flora during wound improvement
Osteomyelitis	Right stump bone pathology: chronic necrotizing osteomyelitis; medullary cavity cleared; infected/necrotic bone re-cut proximally when required; verified intravenous antimicrobial therapy was intermittent between January 8 and March 9, 2026, with no antimicrobial therapy documented from January 20 to February 1; antimicrobials were discontinued after adequate source control and improvement of inflammatory indicators; no oral or intravenous antibiotics continued after discharge; no antimicrobial therapy at the March 30 follow-up
NPWT material and mode	Black polyurethane foam; continuous negative pressure; generally −200 to −100 mmHg; pressure initiated near −200 mmHg for heavy exudation and gradually titrated toward −100 mmHg according to pain and bleeding/ischemia risk; periwound skin protected with a barrier film
NPWT cycles	January 8, January 13, January 20, February 2, February 13, February 25 and March 4, 2026; total approximately 54 days
Complications	Early pain improved after sciatic nerve re-management; no major hemorrhage, uncontrollable leak or clinically significant tube obstruction recorded
Outcomes	Complete wound closure by discharge on March 16, 2026; no recurrence or exudation at follow-up on March 30, 2026; not yet suitable for prosthetic fitting

CRKP, carbapenem-resistant *Klebsiella pneumoniae*; CTA, computed tomography angiography; NPWT, negative pressure wound therapy.

delayed closure. The right stump had an initial wound area of approximately 16.0 × 13.0 cm, and the left stump had an initial wound area of approximately 18.0 × 12.0 cm. The right groin wound measured 6.5 × 4.0 cm. Although detailed wound measurements after every operation were not available, operative records documented repeated removal of necrotic tissue, cavity contraction, improvement in granulation, and progressive closure.

By the later repair stages, the deep cavities had become smaller, necrotic tissue had markedly decreased, drainage was controlled, and granulation tissue was more evident than at admission. The wounds achieved complete closure by discharge on March 16, 2026. At the final available follow-up on March 30, 2026, there was no wound exudation, sinus tract, recurrent dehiscence, exposed bone, recurrent infection, or significant stump pain. The patient was not yet suitable for prosthetic fitting, and continued rehabilitation and vascular follow-up were recommended (Fig. 2).

Discussion

This case was clinically distinctive for four reasons. First, the patient had bilateral above-knee stump ulcers rather than a unilateral postoperative wound problem. Second, the wounds occurred in the setting of severely compromised arterial inflow, which limited healing potential and increased the risk of repeated breakdown. Third, wound secretion culture yielded CRKP, and bone pathology confirmed chronic necrotizing osteomyelitis, although bone culture was not available, indicating a deep infectious burden. Fourth, the therapeutic goal was staged stump salvage and wound-bed preparation rather than immediate one-stage definitive closure. These features correspond to the high-risk wound, ischemia, and infection domains emphasized in threatened-limb risk stratification.[2,8]

The management of infected amputation stumps in ischemic limbs is difficult because excessive debridement may jeopardize residual tissue, whereas insufficient debridement perpetuates infection. Our strategy was therefore to perform repeated selective debridement, preserve as much viable tissue as possible, and use NPWT as a bridge between operations. This approach is consistent with wound-bed preparation principles and with guidance that NPWT should be applied after adequate debridement and source control, rather than as a substitute for debridement.[4-7,9-11]

The present case also fits only partially within existing clinical management guidance. Guidelines for severe soft-tissue infection emphasize source control, microbiological assessment, and targeted antimicrobial therapy.[1,12] Osteomyelitis literature emphasizes infected-bone management and adequate antimicrobial duration.[3] Recent literature supports ceftazidime-avibactam as an important option against carbapenem-resistant *Klebsiella pneumoniae*, although successful treatment still depends on susceptibility and source control.[13] In chronic limb-threatening

Table 3. Chronological timeline of staged wound management

Date	Intervention	Key findings/purpose
2026-01-06	Admission	Bilateral stump dehiscence with pain and heavy exudation; poor arterial inflow evidenced by pre-referral CTA/angiography and vascular surgery consultation; quantitative perfusion assessment (ABI, transcutaneous oximetry, skin perfusion pressure) was not performed
2026-01-08	First staged debridement + NPWT	Extensive debridement of necrotic tissue; right medullary cavity cleared; irrigation; black foam NPWT applied to both stumps and right groin wound
2026-01-13	Second debridement/repair + NPWT	Residual necrotic tissue removed; partial layered closure performed where feasible; NPWT re-applied
2026-01-20	NPWT renewal/wound management	Ongoing drainage management and wound-bed preparation
2026-02-02	Further staged stump repair	Wound bed improved; additional debridement and delayed repair performed
2026-02-13	Repeat staged repair	Cavity and soft tissues continued to improve; selective closure advanced
2026-02-25	Additional repair + NPWT	Further contraction of wound cavity; culture grew *Corynebacterium striatum*; no antibiotic change because wound was clinically improving
2026-03-04	Latest recorded inpatient repair	Freshening of wound edge and further closure performed; staged response achieved
2026-03-16	Discharge	Wounds completely healed
2026-03-30	Follow-up	No exudation, sinus tract, recurrent dehiscence, exposed bone, recurrent infection or significant pain; prosthetic fitting not yet suitable

ABI, ankle-brachial index; CTA, computed tomography angiography; NPWT, negative pressure wound therapy.

Table 4. Verified antimicrobial treatment course

Period	Antimicrobial regimen	Clinical rationale/response
2026-01-08 to 2026-01-12	Cefoxitin 1 g twice daily + levofloxacin 500 mg once daily	Initial broad antimicrobial coverage after admission/debridement
2026-01-13 to 2026-01-19	Levo-ornidazole phosphate 1000 mg once daily + ceftazidime-avibactam 2.5 g twice daily	Escalated coverage after CRKP identification and wound-bed reassessment
2026-01-20 to 2026-02-01	No antimicrobial therapy documented	No verified antimicrobial regimen was recorded during this interval
2026-02-02 to 2026-02-09	Levo-ornidazole phosphate 1000 mg once daily + ceftazidime 1 g twice daily	Post-repair antimicrobial coverage
2026-02-09 to 2026-03-09	Ceftazidime-avibactam 2.5 g twice daily	Targeted CRKP-oriented antimicrobial treatment; edema, exudation and inflammatory indicators improved
Verified intravenous antimicrobial period	Treatment was intermittent between January 8 and March 9, with no antimicrobial therapy documented from January 20 to February 1; antimicrobials were discontinued after source control and clinical improvement and were not continued after discharge	Used with surgical source control and bone management

CRKP, carbapenem-resistant *Klebsiella pneumoniae*.

Fig. 2. Wound condition after staged stump repair and closure. The photographs were taken at the follow-up visit on March 30, 2026 (two weeks after discharge), showing complete closure of the bilateral stumps with no recurrence, exudation or exposed bone.

ischemia, vascular evaluation and revascularization are important when feasible.[2] In the present patient, however, immediate revascularization was not considered feasible because of extensive multilevel occlusion, poor outflow, and active bilateral infection. The treatment therefore represented a pragmatic salvage pathway under constrained vascular conditions, rather than a standard reconstructive pathway.

The case can be compared with several reports on amputation and stump management. Fisher *et al*.[14] compared one-stage and two-stage amputation strategies for wet gangrene, highlighting the value of staged source control in contaminated limb conditions. Van Ross *et al*.[15] examined early mobilization in dysvascular transtibial stump wounds, indicating that rehabilitation and wound management must be coordinated rather than separated. Babić *et al*.[16] reported the use of NPWT for complications after above-knee amputation, supporting NPWT as a tool for stump complication management. More recent studies of closed-incision NPWT after major lower-extremity amputation, including a retrospective study, a 2025 meta-analysis, and a randomized trial, suggest a potential reduction in wound complications, but many focus on closed incisions rather than open, bilateral infected stump cavities with CRKP and osteomyelitis.[17-19] Balan *et al*.[20] described a salvage strategy for below-knee stump complications, but the present case differs by involving bilateral above-knee stumps, severe arterial inflow compromise, and chronic necrotizing osteomyelitis.

Another important lesson was the need to integrate local wound care with systemic assessment. The patient had anemia, reduced prealbumin, and major vascular occlusive disease. Local wound treatment alone would have been insufficient without antimicrobial treatment guided by microbiology, nutritional support, pain control, anticoagulation, and continued vascular-protective care. The documentation of chronic osteomyelitis strengthened the rationale for repeated surgical source control and a prolonged antimicrobial plan. Finally, the observed outcome was short-term: the final follow-up on March 30, 2026, was only two weeks after discharge, so the durability of wound closure and the risk of late recurrence remain unknown.

Limitations

This report has several limitations. First, it describes a single patient, and the findings cannot establish the superiority of NPWT plus staged debridement over other strategies. Second, part of the clinical history before transfer was retrospective and incomplete; smoking, alcohol exposure, complete pre-referral medication history, and some perfusion tests, such as ABI or transcutaneous oxygen pressure, were not available. Third, detailed wound measurements after every operation were not recorded, so the wound-healing trajectory could not be quantified at all time points. Fourth, drug susceptibility details were incompletely available in the submitted records, although the verified antimicrobial course and clinical response were added. Fifth, the final follow-up was short, ending on March 30, 2026, and therefore durable closure, late reinfection, recurrent dehiscence, vascular events, survival prognosis, and eventual prosthetic fitting remain uncertain. These limitations should be considered when interpreting the clinical significance of the case.

Conclusions

In a patient with infected bilateral above-knee amputation stump ulcers complicated by poor arterial inflow, CRKP infection, and chronic necrotizing osteomyelitis, NPWT combined with serial staged debridement, infected-bone management, culture-guided CRKP-oriented antimicrobial therapy, and delayed stump repair achieved complete wound closure by discharge, with no recurrence at the short-term follow-up only two weeks later. This staged strategy was a feasible short-term salvage approach in this selected patient when immediate revascularization and one-stage closure were unsafe; however, the outcome was short-term and durability remains unknown, so longer follow-up and additional cases are needed to assess durability and generalizability.

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Conflict of interest

The authors declare no conflict of interest.

Author contributions

YL collected and organized the clinical data, contributed to clinical interpretation, and drafted the initial manuscript. YG conceptualized the report, supervised manuscript development, critically revised the manuscript for important intellectual content, and serves as the corresponding author. Both authors approved the final manuscript and agree to be accountable for all aspects of the work.

Ethical statement

This work was conducted in accordance with the Declaration of Helsinki (as revised in 2024). The report was prepared in a de-identified manner. Institutional review board approval was waived by the Ethics Committee of Shanghai Yangsi Hospital because this was a retrospective single-case report with written informed consent obtained from the patient. Written informed consent for publication of the clinical details and images was obtained from the patient himself. The patient was conscious and had the capacity to provide informed consent.

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