PLASTIC RECONSTRUCTIVE & REGENERATIVE SURGERY

ONLINE FIRST 2026; OCT 28
DOI: 10.57604/PRRS-2617

CROSS-LEG SURAL FLAP FOR LIMB SALVAGE AFTER BALLISTIC FEMORAL TRAUMA: CASE REPORT

Arnaud Cadillon[1], Pierre Haen[1], Lilian Gaubert[2], Yaotse Siliadin[2], Ammar Ghabi[2]

[1] Department of Maxillofacial and Plastic Surgery, Laveran Military Teaching Hospital, Marseille, France; [2] Department of Orthopaedic Surgery, Laveran Military Teaching Hospital, Marseille, France

Summary

Complex lower-limb reconstruction after ballistic trauma remains challenging when infection, repeated debridement and vascular compromise limit conventional options. We report the case of a 39-year-old active-duty soldier who sustained polytrauma after an improvised explosive device blast, including a comminuted open femoral fracture. Following staged bone reconstruction, recurrent multidrug-resistant infections and repeated revisions resulted in distal lateral thigh soft-tissue loss with exposed osteosynthesis material. Free flap reconstruction was considered unsafe after multidisciplinary assessment because the femoral recipient field was clinically unreliable. A contralateral distally based cross-leg sural flap was therefore performed and both limbs were stabilised with a Hoffmann III external fixation construct. Flap autonomisation was confirmed at 3 weeks and pedicle division was completed successfully. At 4-month follow-up, before the patient was lost to follow-up, coverage remained stable without hardware exposure or further surgery, and the patient was walking with a cane. This case illustrates that cross-leg pedicled flaps remain relevant in modern limb salvage when microsurgical reconstruction would expose the patient to excessive risk.

Key words: surgical flaps, limb salvage, wounds, gunshot, lower extremity, reconstructive surgical procedures, wound infection, microsurgery, case reports

Received: June 30, 2026
Accepted: July 29, 2026

Correspondence
Arnaud Cadillon
E-mail: arnaud.cadillon@intradef.gouv.fr

How to cite this article: Cadillon A, Haen P, Gaubert L, et al. Cross-leg sural flap for limb salvage after ballistic femoral trauma: case report. PRRS Online First 2026;Oct 28. https://doi.org/10.57604/PRRS-2617

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INTRODUCTION

High-energy ballistic injuries of the lower limb may create composite skin, muscle, bone, nerve and vessel defects and remain difficult to reconstruct after infection, repeated debridement and orthopaedic revision [1]. First described by Hamilton in 1854 and later popularised by Stark in 1952, the cross-leg flap was a key lower-limb reconstructive option before microsurgery. Its indications have narrowed, but contemporary reviews confirm a persistent role in extensive recipient-vessel injury, failed free flaps, paediatric reconstruction and modern variants such as perforator-based or cross-leg free flaps [2-5].

The distally based cross-leg sural flap imports vascularised tissue from the contralateral calf while preserving the major arterial axes [6]. We report the use of this flap for limb salvage in a ballistic polytrauma patient with compromised femoral vascular access.

CASE REPORT

A 39-year-old male active-duty soldier, who was an active smoker, was admitted to the Armed Forces Teaching Hospital Laveran, Marseille, France, in October 2023 after polytrauma caused by an improvised explosive device. His injuries included right-sided burns, complex right upper-limb fractures with soft-tissue loss, a proximal left ulnar fracture and a comminuted open fracture of the left femur with neurological impairment.
Initial treatment included soft-tissue debridement, split-thickness skin grafting and humero-ulnar and femorotibial external fixation. The femoral injury subsequently required staged reconstruction using the induced membrane technique. Recurrent multidrug-resistant infections led to repeated debridements and implant revisions, resulting in distal lateral thigh soft-tissue loss with exposure of osteosynthesis material (Fig. 1).



Figure 1. Distal lateral thigh wound dehiscence following repeated debridements and implant revisions.

During further reconstruction in January 2026, exchange intramedullary nailing and durable coverage were required. Major amputation was discussed but avoided because contralateral upper-limb impairment would have severely compromised autonomy. Preoperative contrast-enhanced CT confirmed patency of the major axes in the contralateral donor limb and showed marked peripheral vascular remodelling of the injured left lower limb. No dedicated Doppler/duplex mapping was performed; flap planning relied on anatomical landmarks. Recipient vessels in the femoral region were considered unsafe for microsurgical anastomosis because of blast injury, CT vascular remodelling, recurrent infection, implant revisions, repeated approaches and scarring. Local options had been exhausted, so a contralateral distally based cross-leg sural flap was selected.
The patient was placed in right lateral decubitus. A 6 x 12 cm fasciocutaneous flap was designed along the sural axis between the gastrocnemius heads. The pivot point was approximately 13 cm proximal to the lateral malleolus, with a sural pedicle of approximately 6 cm. The pedicle was kept approximately 5 cm wide, raised with a broad adipofascial cuff and left untunnelled. Exchange intramedullary nailing was performed with a 12 x 400 mm antegrade femoral nail. The flap was inset without tension, and both limbs were stabilised in a cross-leg position with a double-bar Hoffmann III external fixator, adjusted to avoid pedicle traction, torsion or compression (Fig. 2).

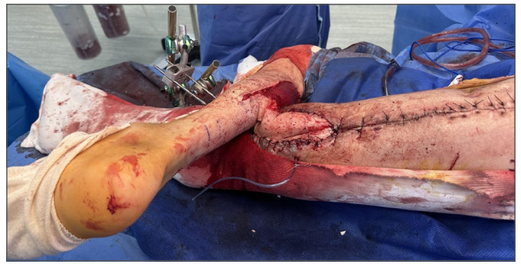


Figure 2. Cross-leg construct after inset of the contralateral distally based sural flap and bilateral lower-limb stabilisation using a double-bar Hoffmann III external fixation system.

Postoperative monitoring focused on colour, temperature, capillary refill and venous congestion. The 3-week cross-leg period was painful and required morphine. The flap remained completely viable. Three weeks later, a clamping test confirmed autonomisation and pedicle division was performed. Stable coverage was obtained after division (Fig. 3). A minor proximal dehiscence resolved with negative-pressure wound therapy. Weight-bearing with crutches was authorised within 15 days of division. At 4-month follow-up, before the patient was lost to follow-up, the flap remained stable, with no recurrent hardware exposure and no further surgery. Radiographs at 3 months showed ongoing bone consolidation. The patient was standing and walking with a cane. Residual absence of knee flexion was accepted



Figure 3. Postoperative appearance after flap autonomisation and pedicle division, showing stable coverage of the distal thigh defect.

because the objective was a stable supporting limb rather than restoration of knee mobility. Pain was mild and controlled with paracetamol.

DISCUSSION

This case illustrates a pragmatic reconstructive solution when the usual microsurgical pathway is unsafe. Ballistic and blast injuries may extend beyond the visible defect and are often complicated by contamination, infection and staged orthopaedic reconstruction.1,7 In our patient, donor-limb vascular patency was confirmed on contrast-enhanced CT, while the injured left lower limb showed marked peripheral vascular remodelling. No dedicated recipient-vessel Doppler or duplex mapping was performed. The decision to avoid free tissue transfer therefore reflected both the CT findings and a multidisciplinary clinical risk assessment, rather than angiographic proof of complete recipient-vessel occlusion.
The cross-leg sural flap imported vascularised tissue from outside the injured femoral territory, avoided microvascular anastomosis, limited further dissection around potentially damaged vessels and provided durable coverage over exposed hardware while preserving the major arterial axes [2-6].
Several alternatives were considered. An ipsilateral reverse sural flap was unsuitable because the defect was located in the distal thigh rather than the distal leg, ankle or foot. A local propeller perforator flap would have relied on perforators within a previously infected and scarred zone of injury. Free anterolateral thigh or latissimus dorsi flaps could have provided large vascularised tissue, but would have required anastomosis to recipient vessels judged unsafe. The cross-leg sural flap was therefore selected as a compromise between reliability, operative safety and limb preservation.
The technique has limitations. It requires staged surgery, temporary lower-limb immobilisation and careful nursing care to prevent pressure injury, venous congestion and thromboembolic complications. Partial necrosis, infection and donor-site morbidity are also recognised risks, especially in smokers or infected wounds [8-10]. These drawbacks must be weighed against the risk of amputation or failed microsurgery.
Cross-leg flaps should not replace free tissue transfer, but they remain useful when recipient vessels are unavailable, unsafe or unreliable. In complex ballistic limb salvage, a traditional pedicled flap may therefore represent the most rational modern option.

CONCLUSIONS

The distally based cross-leg sural flap remains a valuable limb-salvage option when lower-limb reconstruction is limited by infection, repeated surgery and clinically unsafe recipient vessels. In this patient, it provided stable coverage, allowed assisted ambulation and avoided

amputation, although staged immobilisation and transient severe pain were important drawbacks.

Conflict of interest statement

The Authors declare no conflicts of interest related to this work.

Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Author contributions

AC: conceptualisation, clinical data collection, literature review, writing - original draft and figure preparation. PH: surgical management, supervision and critical revision of the manuscript. LG, YS and AG: orthopaedic management, clinical data collection and critical revision of the manuscript. All Authors approved the final version of the manuscript.

Ethical considerations

Written informed consent was obtained from the patient for publication of this case report and accompanying images. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Institutional review board approval was not required for this single case report according to institutional policy; no reference number was issued.
The patient gave written consent to publication of the article and use of the images.

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