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CASE REPORT
Reconstructive

A Myocutaneous Latissimus Dorsi Propeller Flap Based on a Single Dorsal Intercostal Perforator

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Summary: This study presents a novel surgical technique for the reconstruction of highly challenging large lower back defects. In this case, a 72-year-old man initially diagnosed with renal cell carcinoma received nephrectomy followed by the dissection of an iliac crest metastasis and repeated high-dose irradiation therapy. Several years later, an osteocutaneous fistula at the right caudal posterior trunk made the reconstruction of the lower back defect necessary. High-dose irradiation of the lower back and poor vascular conditions at the pelvic region disqualified the patient for previously published local or free flap options. The initial strategy of an arteriovenous loop anastomosed to the femoral vessels and a free latissimus dorsi flap transfer had to be withdrawn due to repeated intraoperative loop thrombosis. For that reason, the entire latissimus dorsi muscle was used as a myocutaneous propeller flap receiving its blood supply solely through a single dorsal intercostal artery perforator. The flap survived completely and no fistulous formation occurred postoperatively. The time to complete wound healing was 4 months. This new technique is considered a valuable addition for the reconstruction of challenging posterior caudal trunk defects. *(Plast Reconstr Surg Glob Open 2021;9:e3881; doi: 10.1097/GOX.0000000000003881; Published online 22 November 2021.)*

The reconstruction of irradiated posterior trunk and gluteal defects poses a challenge for surgeons. Soft-tissue defects at the lower back are often accompanied by exposure of bony structures and large hollow spaces.[1] Increasing knowledge of the angiosome and perforasome concept led to numerous fasciocutaneous perforator-based flaps.[2,3] However, local fasciocutaneous perforator flaps often lack coverage of the entire defect due to its limited mobility and size.[1,3] Therefore, reconstruction of large trunk defects often requires free myocutaneous or muscle flap transfer.[4,5] Wounds caused by high-dose radiation, however, mostly lack adequate recipient vessels for free flap procedures. Arteriovenous loops using autologous vein grafts can remedy this issue. However, the implementation of an arteriovenous loop for free flap transfer usually remains last resort.[6,7] To the best of our knowledge, this case report describes the first published myocutaneous propeller flap harvesting the entire latissimus dorsi muscle Based on a single dorsal intercostal perforator.

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CASE REPORT

A 72-year-old man diagnosed with renal cell carcinoma over 20 years ago initially received nephrectomy of the right kidney. Two years later, a metastasis at the right iliac crest required the resection of the iliac mass followed by immuno-, chemo-, and radiotherapy. External beam radiation therapy of the lower back, the sacrum, and the gluteal area was performed in 2002 with a dose of 50 gray (Gy). After resection of the iliac crest metastasis and polymethylmethacrylate cement spacer implantation into the iliac crest defect, external beam radiation therapy was repeated with another 50 Gy. In October 2020, the patient presented with a history of a purulent radiation ulcer at the right iliac crest persisting for more than 1 year. Magnetic resonance imaging showed an osteocutaneous fistula formation communicating with the bony defect at the right iliac crest. Radical debridement of the radiated soft and

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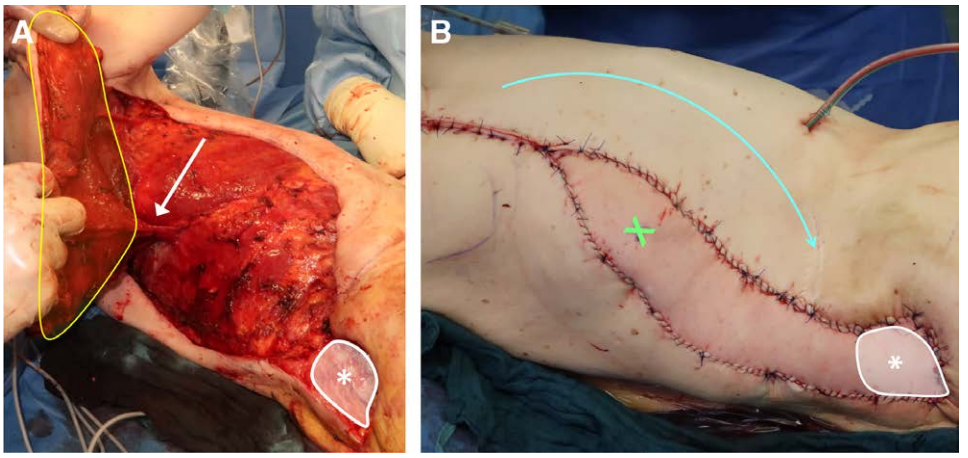

Fig. 1. Intraoperative images. A, The myocutaneous latissimus dorsi flap (yellow line) with a single dorsal intercostal perforator (white arrow) as its sole blood supply. The white asterisk indicates the lower back defect. B, Complete wound closure of the lower back defect. Blue arrow marks 180 degree rotation of the latissimus dorsi flap. The white asterisk indicates the previous lower back defect. Green cross marks the pivot point and subsequently the dorsal intercostal perforator.

bony tissue and removal of the loose cement spacer was performed. The excised tissue underwent pathological examination confirming a fistulous formation without any histopathological or immunohistochemical signs of malignancy. Radiography of the pelvis revealed a stable pelvic ring which allowed ambulation of the patient. Negative pressure wound therapy (KCI—an Acelity company, San Antonio, Tex.) with instillation and dwell time was temporarily applied for wound bed preparation. Computed tomography scan revealed poor vascular condition of the tissue close to the lower back defect (lumbal, sacral, and gluteal area). Due to the extent of the radiation damage, a free latissimus dorsi myocutaneous flap transfer was indicated in a two-stage procedure.

Arteriovenous Loop

At first, an arteriovenous (AV-) loop designed as a recipient vessel using an autologous saphenous vein graft was anastomosed to the femoral vessels by a vascular surgeon. The AV-loop had consistent pulsatile blood flow and remained patent until free flap transfer was initiated one week after the loop was established. The harvesting of the latissimus dorsi muscle with a large skin paddle was performed, while simultaneously dissecting the recipient AV-loop. At this stage, with the patient placed in the left lateral position, a graft thrombosis appeared intraoperatively after exposure of the AV-loop. Immediate thrombectomy and reanastomosis of the AV-loop was performed. However, shortly afterwards the AV-loop thrombosed again intraoperatively. This led to a significant procedural change.

Myocutaneous Latissimus Dorsi Perforator Propeller Flap

Because the latissimus dorsi muscle was already partially harvested, the entire muscle (including a large skin paddle) was elevated based on a single dorsal intercostal perforator between the ninth and tenth rib (Figs. 1A and 2). Dissection of the large skin paddle enabled complete epithelial wound closure at the lower back after flap rotation. indocyanine green angiography (SPY Elite, Stryker Corporation, Kalamazoo, Mich.) was performed after temporarily clamping the thoracodorsal vessels, confirming an adequate perfusion of the myocutaneous flap through its single perforator. The thoracodorsal vascular pedicle and nerve were then ligated, and the perforator was dissected with a pedicle length of 5 cm. A 180 degrees rotation of the flap and deepithelialization of the skin paddle tip enabled complete wound closure and filling of the large void at the right lower back (Fig. 1B). Indocyanine green angiography confirmed adequate perfusion of the transferred tissue.[8] The remaining postoperative course was uneventful (Fig. 3). The time to complete wound healing was 4 months with complete flap survival.

CONCLUSIONS

The premise of any successful reconstructive procedure is to ensure complete wound closure by covering bony structures and to obliterate any wound cavity with

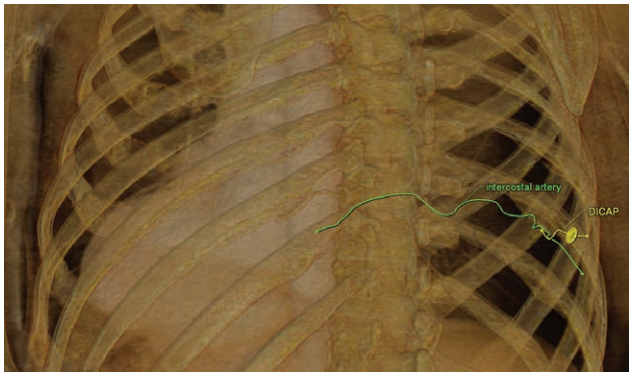

Fig. 2. Volume rendering technique of the trunk showing the course of the intercostal artery (green) and the dorsal intercostal artery perforator (yellow) used as sole blood supply for the myocutaneous latissimus dorsi perforator propeller flap.

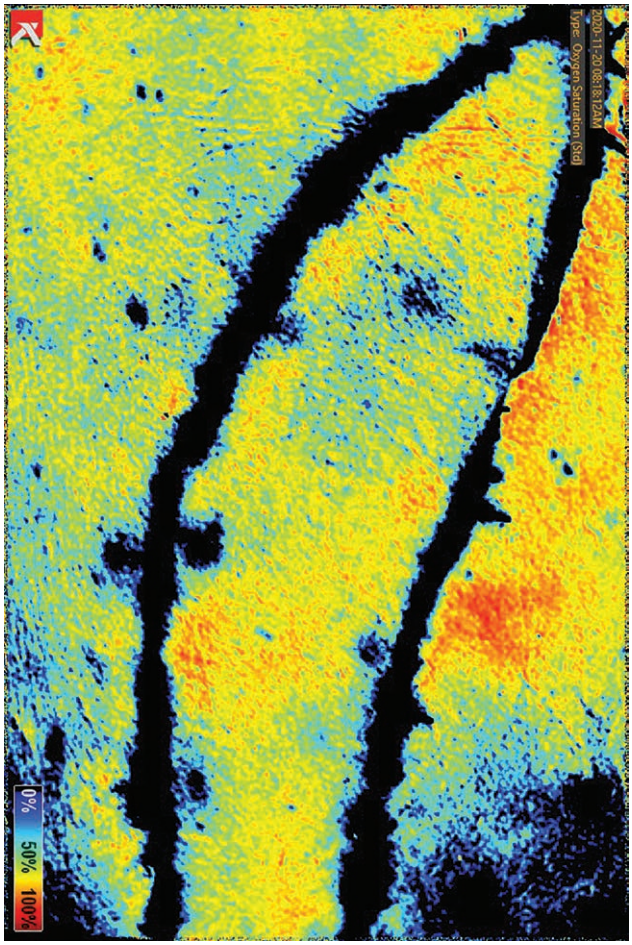

Fig. 3. Near infrared hyperspectral technique showing an adequate tissue oxygenation (>50%) of the skin paddle of the myocutaneous latissimus dorsi perforator propeller flap four weeks after surgery. The scars around the skin paddle mark areas of physiologically lower tissue perfusion (dark blue).

well-vascularized tissue.[1,3,4] The latissimus dorsi muscle, classified as a type V muscle, receives its blood supply from the thoracodorsal artery and additional segmental perforators of the intercostal and lumbar arteries.[4] Its large size, high resistance, and reliable vascular network make it a commonly used, highly versatile, and efficient option for the reconstruction of posterior trunk defects.[4,5] Besides harvesting the latissimus dorsi muscle as a free flap, previous literature showed its successful use as a rotational, extended, or reverse-flow flap either based on the thoracodorsal artery or on multiple segmental intercostal or lumbar perforators.[2,4,9,10]

We, however, report a case where the entire latissimus dorsi muscle was used as a propeller flap based on a single dorsal intercostal perforator. Achieving full wound coverage with well-vascularized tissue required flap rotation on its pedicle of about 180 degrees. We note that this was not our primary objective. However, an unexpected AV-loop thrombosis made us reject the initial strategy of a free flap transfer using the AV-loop as recipient vessel. The posterior caudal trunk remains one of the most challenging reconstruction areas. AV-loop thrombosis rates of 60% when installed at the femoral vessels outline the risk of free flap failure.[6] In general, the implementation of an AV-loop irrespective of its location requires meticulous consideration if no other plausible option remains.[6] Therefore, local flaps remain the preferable reconstructive option for the reconstruction of lower back defects, if any possible. To the best of our knowledge, this is the first published case where an entire myocutaneous latissimus dorsi flap was harvested on a single dorsal intercostal perforator and was rotated 180 degrees on its pedicle as a propeller flap for the reconstruction of a posterior trunk defect. It is considered a valuable addition to the portfolio of local perforator flaps for the reconstruction of the posterior trunk, ultimately avoiding a more challenging and sophisticated free flap approach.

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