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Case Report

VRAM flap for an above knee amputation stump [☆]

A.O. Wamalwa ^{a,*}, S.O. Khainga ^b

^a Plastic Surgeon, Plastic Surgery & Burns Unit, Kenyatta National Hospital, P.O. Box 2572-00202, Nairobi, Kenya

^b Department of Surgery (Plastic), University of Nairobi, P.O. Box 2212-00202, Nairobi, Kenya

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ABSTRACT

Although routinely utilized in reconstruction of groin, perineal and thigh defects, the pedicled vertical rectus abdominis myocutaneous (VRAM) flap has only once been previously reported for coverage of above knee amputation (AKA) stumps. A 36 year old man sustained a traumatic above knee amputation after stepping on an improvised explosive device (IED). Following several sessions of debridement, an ipsilateral pedicled VRAM flap was utilized to provide padded soft tissue coverage and maintain bone length (6 cm below the greater trochanter), avoiding both a debilitating hip disarticulation and a need for a free flap. We describe this procedure, report the outcomes and discuss considerations for utilizing this flap.

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* Corresponding author.

E-mail address: aleoke@gmail.com (A.O. Wamalwa).

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Introduction

The vertical rectus abdominis myocutaneous (VRAM) flap is a robust flap that sufficiently pads and nourishes underlying structures. Its qualities have favored its routine use in reconstruction of pelvic/perineal, groin and thigh defects.^{1–3} We revisit the unique application of the VRAM flap in coverage of an above knee amputation (AKA) stump.

Case presentation

A 36 year old male sustained a left traumatic AKA from a blast injury after walking over an improvised explosive device. While under the care of the orthopedic surgery service, he was successfully resuscitated, put on supportive management and underwent two sessions of surgical debridement; during which the devitalized zones of the wound were noted to be progressing proximally and proving difficult to control.

A plastic surgery consultation was sought for consideration of a hip disarticulation and closure of the stump. Serial debridement was done every five to seven days to the stump during which negative pressure wound therapy (NPWT) was applied after each session. The wound became infected and resulted in bacteremia evidenced by concurrent growth of *Enterobacter cloacae* in wound tissue, urine and blood cultures. Antibiotics were administered based on culture sensitivity results.

Six weeks post injury, the stump was resurfaced with an ipsilateral pedicled VRAM flap once healthy granulation tissue had developed and wound tissue culture was confirmed negative (see [Figure 1](#)).

The infraumbilical anterior rectus fascial sheath was not harvested with the flap (see [Figure 2](#)).

A flap incisional site NPWT device was applied after inseting. Primary fascial closure using polydioxanone 2.0 was done to the infraumbilical region (see [Figure 3](#)).

A bridged polypropylene mesh repair of the supraumbilical fascial defect was done using polydioxanone 2.0 suture and a NPWT device applied. An area adjacent to the flap recipient site dehiscd due to a superficial surgical site infection. This area was debrided and silver-impregnated hydrofiber dressing applied; it healed secondarily within a week. A bovine collagen sheet dressing was applied to the poorly developing granulation tissue over the bridged-mesh to promote granulation. Two weeks later, a sheet split thickness skin graft was utilized to close the wound with noted 100% take thereafter (see [Figure 4](#)).

The patient underwent compression bandaging to mold the stump after fitting for a prosthesis. Six months post AKA stump coverage, he was ambulant on axillary crutches and has neither a visible or palpable donor site bulge or hernia. The patient is still on follow up.

Discussion

The extensive and poorly demarcated zones of injury are characteristic of a blast injury and necessitated serial debridement with NPWT.⁴ A short open AKA stump that significantly lacked soft tissue, was prone to microbial colonization and the need to facilitate prompt rehabilitation were clear indications for a well vascularized bulky flap. In the only other report of a VRAM in AKA stump closure by Rees et al., the stump had adequate soft tissue permitting a skin flap design that allowed primary closure of the donor site.⁵ Notably, there was no mention of the techniques employed in the fascia repair.

Opting against a fascia-sparing VRAM flap was the senior author's decision preference which allowed the skin flap to be designed without doppler perforator mapping. The circular nature of the stump defect obviated the need for an oblique rectus abdominis myocutaneous (ORAM) or extended rectus abdominis myocutaneous (extended RAM) skin design.^{6,7}

A bridging non-absorbable mesh repair was performed to the supra-umbilical region as has been reported previously.⁸ This has been the senior author's preference over previously reported unilateral component separation to assist primary fascial closure.⁹ Although Baumann and Butler assert that there were fewer complications with component separation, it should be noted that the comparison done was of primary fascial closure to component separation; and skin was closed primarily in those



Figure 1. Surgical marking of the ipsilateral vertical rectus abdominis myocutaneous (VRAM) flap and recipient site with good granulation tissue over the above knee amputation (AKA) stump.



Figure 2. Elevated ipsilateral vertical rectus abdominis myocutaneous (VRAM) flap.



Figure 3. Bridged mesh repair (supra-umbilical) and primary fascial closure (infra-umbilical) of the flap donor site and flap inset over the stump.



Figure 4. Completely healed donor and recipient sites at six (6) weeks post-surgery.

patients.¹⁰ The verdict is still out on post-operative risk of hernia or bulge between component separation and bridged mesh repair. The aesthetic outcome of bridged mesh repair and unilateral component separation is arguably similar in context of skin closure using a skin graft. We utilized NPWT over the mesh as a temporizing measure while sourcing for a dermal matrix. Granulation tissue formation accelerated on application of the collagen sheet, ensuring good graft take and limiting contour deformity. There were no signs of granulation tissue infection or biofilm contamination of the mesh while on NPWT which we attribute to the “closed-circuit” nature of the system that was applied aseptically. The infra-umbilical region was repaired primarily as the fascial integrity was judged to be good and the repair was tension-free. So far, this has not precipitated a bulge or hernia. However, we acknowledge that the follow up period is limited. The recipient site experienced delay in wound healing due to surgical site infection, which we attribute to the difficult nature of blast injuries.

Free tissue transfer and dermal regeneration matrices were options we contemplated on for resurfacing the stump. A long-pedicled bulky flap that would facilitate anastomosis away from the zones of injury and prior infection (where vessels were fibrotic and friable) with minimal donor site morbidity were qualities sought. However, the patient was against a free flap; a decision likely influenced by his tumultuous medical recovery riddled with multiple surgical procedures. A dermal matrix would have limited the donor site morbidity to only a skin graft donor site.¹¹ High cost and scarcity limited its use. Another concern was adequacy of the soft tissue padding necessary for weight bearing.

Although significant resources were utilized in maintaining the stump, a hip disarticulation portended morbidities like difficulty in wearing of the prosthesis, impaired ambulation with increased energy consumption and in our setup, limited availability of the hip disarticulation prosthesis.¹² The downside of the insensate flap is the necessity for a precise fitting prosthesis and regular skin inspection to portend signs of break down like blanching, bruising or erythema.

Conclusion

This report highlights utility of the vascularized bulky VRAM flap in coverage of an exposed short AKA stump, where local soft tissue is lacking.

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Ethical approval

Informed consent was acquired from the patient to publish the anonymized images and approval was granted by the Kenyatta National Hospital/University of Nairobi Ethics and Research Committee (KNH/UoN- ERC) – Ref no. KNH-ERC/01/PUB/3.

Declaration of Competing Interest

None.

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