The use of Negative Pressure Wound Therapy (NPWT) in complex surgical wounds of the lower extremity

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Introduction

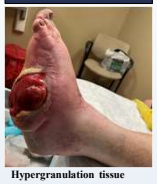
A collection of multiple case reports was compiled on select patients with significant co-morbidities and complex wounds who were at high risk for proximal amputation of the affected limbs. Patients are often faced with complications including long hospital stays, wound infection, osteomyelitis and limb loss due to challenges associated with healing full-thickness wounds. With no clear consensus regarding the best methodology for closure, the technique applied each time is largely the surgeon's preference. In this multiple case report, various advanced wound closure methods in multiple cases are assessed and utilized for limb salvage.

Methods

Multiple case reports including:
(Case 1) male patient with chronic ulceration, infection and deformity requiring application of external fixator and initially using Jacob's ladder suture technique before converting to NPWT (negative pressure wound therapy) for skin closure;
(Case 2) female patient with severe sepsis, critical limb ischemia requiring emergent partial amputation followed by application of skin graft and NPWT;
(Case 3) male patient with compartment syndrome received multiple fasciotomies of the leg, resulting in a total of five wounds requiring meshed fish skin grafts with bridging between wound sites for continuous NPWT application at 125mmHg;
(Case 4) male patient with with chronic venous insufficiency and 3 large ulcers encompassing the right ankle. The patient was referred to the surgeon for aggressive wound debridement and advanced wound care due to deterioration and active infection. After resolution of infection, the wounds were debrided prior to placement of grafts and NPWT.

Results

Case 1



Hypergranulation tissue with underlying osteomyelitis to 4th and 5th metatarsals.

After confirmation that all infected bone and soft tissue was removed, application of skin substitute and Jacobs ladder suture technique was utilized for skin closure.

Application of external fixator was used to aid in healing large soft tissue defect. After initial use of vessel loops and Jacobs ladder technique, NPWT and application of skin substitute was utilized for rapid skin closure.

Case 2

Gas gangrene case with initial treatment of I&D, toe amputation and removal of non-viable for source control.

After transmetatarsal amputation was performed, weekly application of skin substitute and application of NPWT was initiated.

Ongoing healing with application of skin substitute. The patient is fully ambulating in orthotic/toe-filler and carbon fiber AFO.

Case 3

S/p multiple fasciotomies of the lower extremity with application of mesh skin substitute and NPWT.

Frequent application of skin substitute and application of NPWT with bridging between 3 to 4 wound sites.

5 application of skin substitute were required and NPWT was utilized for less than 2 months prior to complete closure.

Case 4

Extensive soft tissue loss with multiple venous ulcers to the right ankle. After clearing infection and removal of non-viable tissue, a clean granulating base was achieved prior to application of graft tissue.

NPWT with bridging between multiple ulcers.

After serial debridements and multiple graft applications all sites were epithelialized soon after this photo was taken.

Discussion

Limb salvage has evolved significantly in recent years due to the progress and innovation of advanced modalities.
Unique anatomical challenges of wounds coupled with the need to optimize patient comorbidities make it challenging for the surgeon to develop a clear consensus when determining the most appropriate treatment modalities to utilize.[1]
Surgeons need to be well-versed with new technologies and understand when to utilize them appropriately. Recent advancements in skin substitutes have shown to have an inhibitory effect on bacterial growth and improve epithelial cell migration.[2] Additionally, newer NPWT systems can dynamically sense and respond to fluctuating fluid volumes and viscosities as the wound environment changes while also providing superior fluid removal.[3,4]
In this multiple case report, a combination of aggressive surgical debridement; application of skin substitutes/grafts; application of NPWT; and offloading with application of external fixator were utilized to assist with rapid wound closure. In patients with PAD and extensive bone and soft tissue loss, successful outcomes were observed in preventing additional proximal amputation, resulting in a functional limb that the patient could ambulate on after wound closure (in some cases with the use of orthotics, toe-fillers and carbon fiber ankle foot orthoses).

References

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