

Attempt of Reconstruction Preparation Following Orbital Exenteration Using Vacuum Assisted Closure

Gilad Winder¹, Stav Sarna Cahan², Moshe Giladi³ and Ayal Hassidim^{2*}

¹Tel Aviv Sourasky Medical Center, Tel Aviv, Israel

²Department of Plastic and Reconstructive Surgery, Hadassah-Hebrew University Medical Center, Jerusalem, Israel

³Department of Physiology and Pharmacology, Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel

***Corresponding Author:** Ayal Hassidim, Department of Plastic and Reconstructive Surgery, Hadassah-Hebrew University Medical Center, Jerusalem, Israel.

Received: October 25, 2017; **Published:** November 20, 2017

Abstract

Vacuum-assisted closure (VAC) has revolutionized wound care over the last 15 years. Previously, VAC was successfully utilized to support split-skin grafting following orbital exenteration due to malignancy. Here, we report an attempt to use VAC following orbital exenteration due to necrotizing fasciitis of the right eyelid, an infections etiology, in a 73 years old male. Although VAC was previously used successfully following necrotizing fasciitis at different anatomical sites, in the reported case the granulation tissue didn't thrive sufficiently for skin grafting and healing of the surgical wound was eventually achieved by secondary spontaneous granulation. The possible causes of VAC failure in this case are discussed, providing a stepping stone for future prospective studies in the field.

Keywords: Vacuum Assisted Closure (VAC); Orbital Exenteration; Necrotizing Fasciitis; Reconstruction; Skin Grafts

Abbreviations

VAC: Vacuum Assisted Closure; GAS: Group A *Streptococcus*; MDWT: Micro Deformational Wound Therapy; NPWT: Negative Pressure Wound Therapy

Introduction

Necrotizing fasciitis is an acute fulminant infection of the subcutaneous soft tissues, particularly fat and deep fascia. The initial clinical presentation may mimic cellulitis but necrosis quickly follows. Group A *Streptococcus* (GAS) and *Staphylococcus aureus* are the frequent isolated pathogens but additional pathogens may be present [1,2]. Mortality in necrotizing fasciitis is attributed to the development of toxic shock syndrome, and early recognition and prompt treatment are essential for patient survival [3]. Although not frequent, several case reports of periocular eyelid involvement with necrotizing fasciitis were described [1,3]. Treatment includes early surgical debridement along with appropriate antibiotics [3-5].

Orbital exenteration is a radical procedure that consists of removing the eye, alongside the extra ocular muscles and surrounding soft tissue; rarely, the bony walls of the orbit may be extracted, with or without lid sparing [6,7]. This psychologically and anatomically disfiguring procedure is generally reserved for orbital malignancies, and occasionally for intractable infections such as mucormycosis and necrotizing fasciitis [6]. A reconstruction procedure of the orbit cavity, tailored to the defect and the patient's will, is required following orbital exenteration and influences the medical and cosmetic outcomes. When a prosthetic is planned, the goal should be to create an open cavity with a skin graft, regional flap, or thin free flap [7,8]. Split or full-thickness skin grafts are used for reconstruction when an open cavity is desired: when there is no need to isolate the orbital cavity from the sinonasal, oral, or intracranial cavities, when radiation therapy is not required at all [7,8].

It is often challenging to apply a split-thickness skin graft in the orbit following orbital exenteration. Skin grafting depends on the quality of the vascular bed. Both hematoma and wound fluid collection may hinder complete skin graft taking. Skillman and colleagues [9] have previously described the advantages of vacuum-assisted closure (VAC) in successful split-skin grafting following orbital exenteration due to malignancy. The procedure was well tolerated by the patient, who was discharged 5 days following the procedure with 100% skin graft taking [9]. Vacuum-assisted closure (VAC) has revolutionized wound care over the last 15 years [10]. VAC is considered a standard adjunctive treatment option for the management of a variety of wound types and anatomical locations [11]. VAC is believed to aid in wound healing by a combination of mechanisms, including fluid removal and optimization of the wound environment [10]. Poor skin graft taking and fixation to the orbit socket were described previously when using other techniques and methods such as inflated balloons, tie-over dressings and fibrin glue, due to uneven pressure distribution [9].

Of note, the use of VAC following infectious etiology such as necrotizing fasciitis at anatomical sites other than the orbit was described. For example, Orhan and colleagues recently described a successful use of VAC dressing for improving skin graft taking on genital area defects following necrotizing fasciitis with 100% skin graft taking among 13 male patients [12].

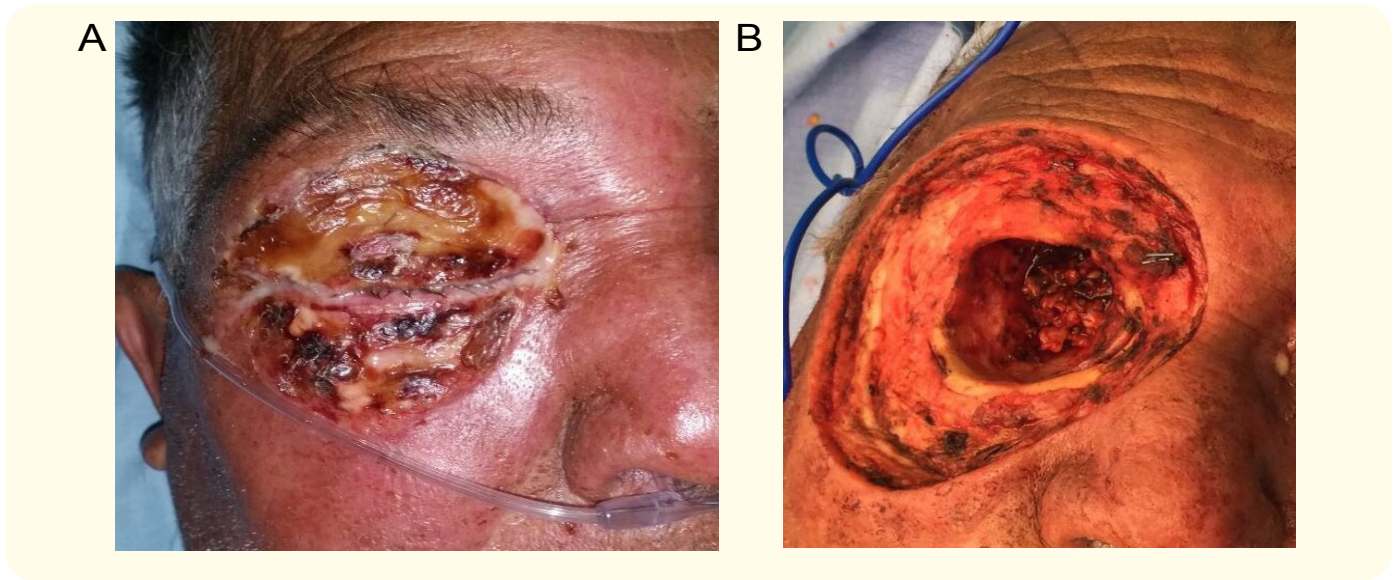
Given the abovementioned considerations, here we present the first report (to the best of our knowledge) of an attempt to use VAC following exenteration of the orbit due to infectious etiology such as necrotizing fasciitis.

Case Presentation

A 73 years old male was admitted to another hospital due to local swelling and redness of his right lower eyelid accompanied by systemic fever. His medical history included diabetes mellitus type II with complications (retinopathy, nephropathy, peripheral neuropathy, stroke and coronary artery disease), hypertension and heart failure (ejection fraction = 30%) due to ischemic heart disease, for which he underwent coronary artery bypass grafting. He also underwent an unknown procedure in his right eye five years prior to presentation, which resulted in right eye blindness. A diagnosis of eyelid cellulitis was made and treatment with IV antibiotics (not specified in his discharge letter) was initiated. After two days of treatment, necrotic tissue developed, and the patient was transferred to Hadassah-Hebrew University Medical Center due to necrotizing fasciitis of the eyelid.

Upon admission, physical examination revealed an alert, hemodynamically stable but ill-appearing patient. Bedside ophthalmologic examination of the right eye demonstrated no light perception in visual acuity test; swelling, redness and discharge with necrotizing tissue in the lower eyelid (Figure 1A); conjunctival injection, cloudy cornea (obscuring further ophthalmoscopic examination) and palpable intraocular pressure. No proptosis or ophthalmoplegia were presented. Laboratory studies demonstrated elevated white blood cell count (19,000 cells/ μ L normal range 4,500 - 11,000 cells/ μ L), elevated C-reactive peptide (41 mg/dL, normal range < 5 mg/dL) and decreased serum albumin (22 g/L, normal range 35 - 55 g/L). Gram stain from the necrotizing tissue showed *Streptococci*, compatible with necrotizing fasciitis of the eyelid. Orbital computed tomography demonstrated pre-septal cellulitis, without intra- or retro-orbital involvement and without evidence of sinusitis.

Given the abovementioned clinical presentation, laboratory and imaging studies, a diagnosis of necrotizing fasciitis was made. IV ceftriaxone, clindamycin and vancomycin were initiated. Urgent total orbital exenteration and debridement of the necrotizing tissue was performed (Figure 1B). Group A *Streptococci* were isolated from the surgical specimen. The patient was transferred to intensive care unit following the debridement. Due to the need for long term ventilation tracheostomy was performed. An open cavity with a skin graft was the reconstructive approach chosen to allow later installation of ocular prosthesis. To improve the chances for successful skin grafting, we sought to use VAC, which has been proved to be a successful bolster for skin grafts, especially in unfavorable recipient beds [9]. VAC using negative pressures of -75 to -120 mmHg has been applied continuously to the wound bed for 2 weeks to encourage granulation tissue formation. However, despite the use of VAC, granulation tissue only appeared focally on areas with previously exposed bone and did not cover the entire bed required for skin grafting. Hence, healing of the surgical wound was achieved by secondary spontaneous granulation. Spontaneous granulation is an effective healing process on the one hand, but takes several months and delays the healing and facial rehabilitation process on the other hand [7]. The patient is currently waiting for prosthetic eye fitting.



Discussion

To the best of our knowledge this is the first documented attempt to use VAC following exenteration of the orbit due to infectious etiology such as necrotizing fasciitis to facilitate skin grafting. Unfortunately, VAC did not achieve the desired results. Our unfavorable results may stem from several reasons.

First, the results may be attributed to the use of excessive negative pressures. VAC facilitates wound healing, but the exact negative pressure needed to be applied to optimize its effects are unknown. Moreover, excessive negative pressure may cause ischemia in wounds with compromised vascularity, and the pressure often needs to be reduced [13]. One *in vivo* study concluded that maximal blood flow effects are seen already when using pressure levels as low as -80 mmHg [14], and in another *in vivo* study, maximum wound contraction was already achieved at -75 mmHg, and this may be a suitable pressure for most wounds [13]. Further research should be conducted in humans in order to determine the appropriate protocol of pressures to be used.

The unfavorable results may also be related to the infectious etiology and the general medical condition of our patient. The patient described here had a variety of vascular comorbidities and complicated diabetes mellitus. Although VAC proved to be a successful therapy, especially among patients with unfavorable recipient vascular bed such as the orbit [9], the combination of unfavorable vascular beds and extensive vascular disease, along with diabetes mellitus which impairs wound healing, may explain the results in our case.

Finally, we used a different reconstructive strategy compared to Skillman and colleagues [9]. Skillman and colleagues applied the VAC dressing onto the skin graft, whereas in our case the VAC was applied to the wound bed to encourage granulation prior to skin grafting. Further studies are required to determine the optimal reconstructive strategy following orbital exenteration.

Conclusion

To conclude, successful use of VAC following exenteration of the orbit due to infectious etiology may be enhanced by further research regarding the surgical technique, strategy of VAC application and improved patient selection.

Bibliography

1. Poitelea C and MJ Wearne. "Periocular Necrotising Fasciitis--a Case Report". *Orbit* 24.3 (2005): 215-217.

2. Hoge CW, *et al.* "The Changing Epidemiology of Invasive Group A Streptococcal Infections and the Emergence of Streptococcal Toxic Shock-Like Syndrome. A Retrospective Population-Based Study". *Journal of the American Medical Association* 269.3 (1993): 384-389.
3. Marshall DH., *et al.* "Periocular Necrotizing Fasciitis: A Review of Five Cases". *Ophthalmology* 104.11 (1997): 1857-1862.
4. Bisno AL and DL Stevens. "Streptococcal Infections of Skin and Soft Tissues". *New England Journal of Medicine* 334.4 (1996): 240-245.
5. Kronish JW and WM McLeish. "Eyelid Necrosis and Periorbital Necrotizing Fasciitis. Report of a Case and Review of the Literature". *Ophthalmology* 98.1 (1991): 92-98.
6. Rose GE and JE Wright. "Exenteration for Benign Orbital Disease". *British Journal of Ophthalmology* 78.1 (1994): 14-18.
7. Zhang, Z., *et al.* "Multicentred International Review of Orbital Exenteration and Reconstruction in Oculoplastic and Orbit Practice". *British Journal of Ophthalmology* (2017).
8. Hanasono MM., *et al.* "An Algorithmic Approach to Reconstructive Surgery and Prosthetic Rehabilitation after Orbital Exenteration". *Plastic and Reconstructive Surgery* 123.1 (2009): 98-105.
9. Skillman, J., *et al.* "Vacuum Assisted Closure (Vac) Dressing for Skin Graft Application Following Exenteration of the Orbit". *Orbit* 22.1 (2003): 63-65.
10. Huang C., *et al.* "Effect of Negative Pressure Wound Therapy on Wound Healing". *Current Problems in Surgery* 51.7 (2014): 301-331.
11. Anghel EL and PJ Kim. "Negative-Pressure Wound Therapy: A Comprehensive Review of the Evidence". *Plastic and Reconstructive Surgery* 138.3 (2016): 129S-137S.
12. Orhan E and D Senen. "Using Negative Pressure Therapy for Improving Skin Graft Taking on Genital Area Defects Following Fournier Gangrene". *Turkish Journal of Urology* 43.3 (2017): 366-370.
13. Borgquist O., *et al.* "The Influence of Low and High Pressure Levels During Negative-Pressure Wound Therapy on Wound Contraction and Fluid Evacuation". *Plastic and Reconstructive Surgery* 127.2 (2011): 551-559.
14. Borgquist Ola., *et al.* "Wound Edge Microvascular Blood Flow During Negative-Pressure Wound Therapy: Examining the Effects of Pressures from -10 to -175 Mmhg". *Plastic and Reconstructive Surgery* 125.2 (2010): 502-509.

Volume 8 Issue 4 November 2017

© All rights reserved by Ayal Hassidim., *et al.*