

## Simple Management of an Acute and Large Wound

Bilgen Can

Department of Plastic Reconstructive and Aesthetic Surgery,  
Balıkesir Atatürk City Hospital, Balıkesir, Turkey

### \*Corresponding author

Bilgen Can, Department of Plastic Reconstructive and Aesthetic Surgery,  
Balıkesir Atatürk City Hospital, Balıkesir, Turkey, Tel: 0530 372 75 82;  
E-mail: bdenizag@gmail.com

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### Introduction and Aim

Wound care has been one of the most important building blocks of plastic surgery from past to present. Currently, The famous reconstruction ladder has been changed in parallel with the development of negative pressure wound therapy, tissue engineering and surgical methods and has been used as a reconstruction matrix. In our study, we aimed to present our approach to acute and wide wounds resulted from crush injury affects on the anterior part of the thigh in the light of the current literature.

### Case Report

A 62-year-old female patient suffered from injury resulted from the work machine on her right thigh was evaluated. The patient had undergone intramedullary nail application by orthopedics because of femur lower end fracture. She was admitted to our outpatient clinic at the first month after surgery with a 24x13 cm necrotic tissue on the anterior thigh and seroma on the lateral thigh (Figure1). The general physical examination findings of the patient were normal. There were no features in the laboratory findings. The patient underwent debridement and necrotic tissue was excised and seroma accumulated in pouch located in the lateral of thigh was evacuated. The patient underwent debridement 3 times on alternate-days. The limit of the necrosis was deep fascia at the base (Figure2). Vac application was performed at the end of third debridement. Negative pressure of the vac adjusted as 100mm Hg, and applied intermittently changing from 5 minutes to 2 minutes and changed once every three days. After the third changing, granulation tissue with healthy bleeding has been obtained on the wound surface (Figure3) and defect area was repaired on from by grafting with split thickness skin graft (STSG) taken from front of the left thigh. Vac applied again on STSG and adjusted as previously. Vac was terminated after three days and changed to classic dressing. When dressing was opened it is observed that graft was intact in 90%. Secondary healing was planned for the remaining defect areas and patient was followed as outpatient follow-up (Figure4).



Figure 1: Necrotic Tissue on the Anterior Thigh



Figure 2: After Consecutive Debridements



Figure 3: After VAC Application



**Figure 4:** After Graft Adaptation

## Discussion

The reconstruction ladder has been the most important guide of plastic surgeons in the approach to the wound. Accordingly, A path is followed from simple to complex for wound closure. Secondary healing is basement and upwardly followed by primary closure, closure with graft, local flaps, regional flaps and free flaps stages. Design of Ladder wound closure primarily begins with simple methods. In cases where these are insufficient, complex methods are applied. After the development of tissue engineering, vacuum treatment and the application of perforator flaps, reconstruction ladder is now replaced by the reconstruction matrix. When it is necessary, reconstruction matrix; considering the risk factors of the patient and requirement of the wound can be performed as sophisticated and complex methods by passing the simple methods on first stage [1]. Advances in microsurgical techniques and the increase of the place of perforator flaps in the practical use have allowed reconstruction matrix to be performed with complex steps in the first stage. Contrastly, Brian et al. evaluated the trends in the closure of soft tissue wounds in their retrospective study and found that reconstruction steps have returned to first steps and usage of free flaps decreased [2]. Moreover, according to the study, there were no significant differences between complex methods and simple methods in terms of long-term results. They attributed this new trend to the practical use of negative pressure wound care [3].

One of the first and most important steps in the approach to an acute wound is debridement. The recovery of unhealthy and nonvital tissues of the wound is the most important key of the healthy wound healing. In the past, the approach is to follow of the the wound by serial debridements in order to protect all possible healthy tissue and late repair. Nowadays it has changed. Aggressive debridement of the wound, the initial debridement of the tissues with suspected vitality, stabilization and early period regression are the current trends [4]. Before the final closure, we took the patient to debridement 3 times on alternate days. We prefer to do serial debridements. The absence of vital structure of the patient such as exposed veins, bones and nerves and the large extent of tissue defect made us think that serial debridement would be more appropriate. In addition, because we planned to repair the wound with graft, we have given the patient time for the formation of healthy granulation tissue and prepared the wound bed in the graft. After the unhealthy and non-vital tissues were cleared, vac was applied. Vacuum therapy accelerates wound healing by leading to mechanical deformation on the wound and removal of excess exudate [5].

Negative pressure triggers biologic cascade by affecting shearing forces in the wound thusly including edema removal, stimulation of

angiogenesis and blood flow to the wound margins, and promotion of granulation tissue formation and woundhealing [6-8].

Additionally removing wound exudate by negative-pressure wound therapy, and thereby optimizing the microenvironment of the wound, most certainly has a positive influence on the healing process. In experimental study of Boruquist et al. which investigate the negative pressure levels and influence on wound healing, it has been showed that wound contraction occurred at a maximum pressure of -75mm Hg and further reduction of pressure after -75 had no effect on wound contraction [9]. The effect of exudate removal has been reached maximum at -125 mm Hg pressure level and had no change after that pressure level. Therefore vacuum application is carried out at -125 mmhg as standard.

As known, the negative pressure at high level decreases the tissue perfusion by increasing the tissue pressure. For this reason, the pressure should be adjusted carefully and applied with low pressure in areas with sensitive to ischemia and vascular damage. Since we have no intense exudation in the patient's wound, we found it appropriate to run 100 mm hg intermittently. In terms of patient comfort, we did not experience any problems with this pressure and we received the response we expect to wound healing. After the second vac replacement wound became available for graft application.

Vac with wash application is the other option for preparing wound. According to a study which compare the negative pressure wound management with vac with wash therapy, the option of vac with wash application may be more cost effective in cases with seriously infective and suspicious about adequate debridement [10]. Since we did not observe the local infection and the exudate in our patient, we did not prefer vac with wash application in line with the study. After the second vac exchange, the wound bed became suitable for grafting and we adapted to the wound bed by grafting STSG in the middle thickness obtained from the other thigh and we continued the vac application with the same setting on the graft. Studies have shown that when vac is applied on the graft there is no any change about the tissue compatibility (i.e quantitatively) but increase the quality of epithelization of the graft [11].

Because we saw a little masseration on the graft when we removed the vac dressing on 3 rd day, we stopped the vac application and continued with oily gas dressing. The use of hyperbaric oxygen has been important trend in recent years. It was firstly used in plastic surgery by Mc Frlaine who reported that it increases the viability of composite grafts in rats in 1966 [12]. The effect mechanism is to ensure the formation of free oxygen radicals in tissue level by increasing the arteriel oxygen pressure. The treatment is applied intermittently and in short time so as not to activate the antioxidant mechanisms. Hyperoxygenation results in enhanced leukocyte function, increased tissue oxygenation, decreased peripheral edema and improved skin viability, thus improves skin flap adherence neovascularization, and penetration of concomitant antibiotic therapy [13]. However hyperbaric oxygen therapy is pretty effective on chronic wounds particularly in diabetic ulcers [14-16]. It is not necessary to be used as an adjunctive therapy in every acute wound and it is not recommended [17]. Prp, stem cell use, electro stimulation vibration and usg energy are the treatment options used in wound healing and forming new steps in reconstruction matrix [18-20].

## Conclusion

No matter how wide the wound is in the acute wounds, management can be provided by adhering to the principles of simple wound care. Debridement is one of the most important steps of wound care. In recent years, there has been a tendency to close wounds with the first steps in the reconstruction ladder. Early and sufficient debridement of the wound and early vac application allow wound closure with simple methods in suitable even wide wounds.

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