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Casi clinici

Case reports

Vacuum-assisted therapy accelerates wound healing in necrotizing soft tissue infections: our experience in two intravenous drug abuse patients

La terapia a pressione negativa (vacuum-assisted) accelera la guarigione della ferita nelle infezioni necrotizzanti dei tessuti molli: esperienza personale in due pazienti tossicodipendenti

Athanasios Marinis, Mavroudis Voultsos, Paraskevas Grivas, Panagiotis Dikeakos, Emmanouil Liarmakopoulos, Nikolaos Paschalidis, Spyros Rizos
First Department of Surgery, Tzaneion General Hospital, Piraeus, Greece

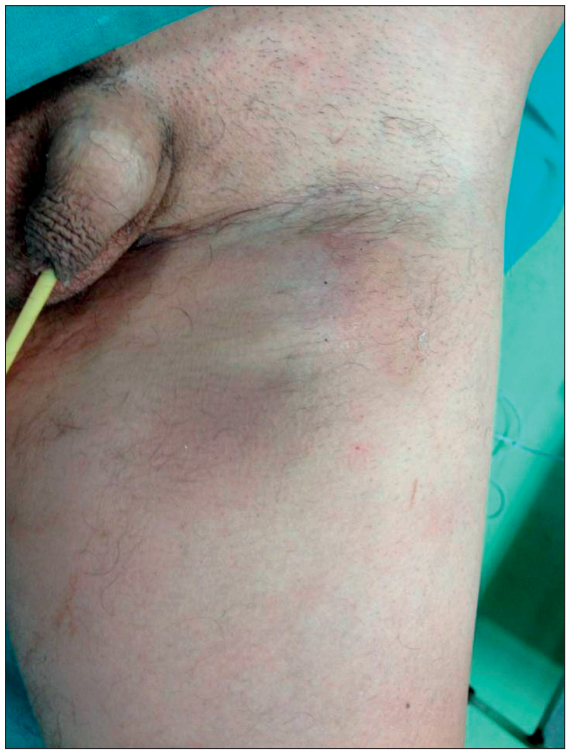
INTRODUCTION

Necrotizing soft tissue infections (NSTIs) are serious and complicated infections affecting the skin, subcutaneous tissue, fascias and muscles and are associated with significant morbidity and mortality when not recognized and treated promptly [1]. A multidisciplinary team of dedicated doctors and nurses, as well as early and aggressive treatment is the most important parameter for a good outcome [2]. Of equal importance is the handling of these complicated wounds. A current, well established therapeutic wound healing modality is the negative pressure therapy applied with the vacuum-assisted closure (VAC) devices. Negative pressure therapy was introduced in clinical practice by Morykwas and Argenta in 1997 and it is nowadays well described, used in a wide spectrum of complicated wounds [3, 4]. In this report we present our experience in intravenous drug abusers managed with VAC for NSTIs.

Corresponding author
Athanasios Marinis
E-mail: drmarinis@gmail.com

CASE REPORTS

Case 1
The first patient was a 34 year old Caucasian male that was admitted to the Emergency Room with an oedematous left inguinofemoral region (Figure 1) and reported high fever during the prior day reaching 40.5°C, along with vomiting. He was abusing intravenous drugs with a reported 10 year addiction to heroin with HCV seropositivity (the rest patient history was unremarkable). The physical signs were typical of a septic patient, namely tachypnea (25-30 breaths per minute), tachycardia (120 beats per minute) and fever (39.4'C) along with marked leukocytosis (WBC 17,5 x10^9/L). Furthermore, the patient exhibited multiorgan dysfunction with blood creatitine levels 4,7 mg/dL, urea 160 mg/dL, total/direct bilirubin 2,51/1,45 mg/dL and mild transaminase elevation (SGOT, SGPT; 103, 60 IU/L), CPK 745IU/L, albumin 1,9 gr/dL, haematocrit 16,3%, haemoglobin 5,7 g/dL, platelet count 130 k/μL, C-reactive protein 280mg/L and INR of 1,27. Serum electrolytes were also affected with sodium measuring 123 mEq/L, potassium 5,1 mEq/L and calcium 6,6 mg/dL. The admission arterial blood gases revealed metabolic acidosis with



◀ **Figure 1 -** Remarkable edema and discoloration of the left inguino-femoral region.

partial respiratory compensation and serum lactate levels of 4,3 mmol/L. Admission ultrasound scan of the area showed a fluid collection in the anterior proximal femoral muscle compartment measuring 2.9x3.2 cm with increased peripheral vascularization indicative of a pus collection with accompanying oedema of the surrounding soft tissues. The calculated LRINEC score (Laboratory Risk Indicator for Necrotizing Fasciitis) was 11 (cutoff for likelihood of necrotizing fasciitis present on top of cellulitis is 6). Physical examination of the inflamed limb revealed a discolored and oedematous left inguinofemoral region, increased temperature when compared with the contralateral limb and pus oozing from a recent puncture site

Figure 2 - Necrosis of the anterior femoral compartment, involving subcutaneous tissue and the middle head of the quadriceps muscle, near the femoral vessels (white star) which was debrided and the VAC device applied.

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at the affected site. The pain in the affected limb during physical examination was out of proportion to the external physical appearance of a typical cellulitis. Based on the above, the decision to proceed to the operating room was taken and the initial aggressive and wide surgical debridement led to the evacuation of an extended pus collection in the superior anterior femoral muscular compartment and the removal of necrotic muscle tissue (myonecrosis affected the middle head of the quadriceps muscle mostly). The evacuated necrotic tissue area was in direct contact with the femoral vessels (Figure 2). Tissue samples and cultures were taken and sent to the microbiology department. The patient was subsequently admitted to the surgical ward to support the basic life systems and monitor the response to therapy. Because the response to therapy was minimal he was taken to the operating room after 12 hours for further additional debridement. He was readmitted to the surgical ward and the following day the vacuum-assisted closure device was applied to the traumatic site (Figure 2). Initial empiric antibiotic coverage included high dose penicillin ($6x10^6$ IU QID, i.v.), clindamycin (600 mg QID initially, i.v.) and metronidazole (500 mg TID, i.v.). It was later adjusted to piperacillin/tazobactam (4.5 g TID, i.v.), clindamycin (600 mg TID, i.v.), metronidazole and fluconazole (200 mg OPD, i.v.) to cover the cultured microorganisms: *Enterobacter aerogenes* and *Acinetobacter baumannii*.

The vacuum assisted closure device (Simex 300, Simex Medizintechnik GmbH, Denmark) was successfully applied to the wound site as follows: continuous negative pressure -125 mmHg for the first week and, thereafter, in an intermittent fashion (-110 mmHg alternating to -80 mmHg). After a subsequent CT scan (2 weeks after admission) showing topical remission of the inflammation with concomitant normalization of inflammatory indices (post-admission CRP: 2 weeks 38,5 mg/L, 4 weeks 2,8 mg/L) and confirmation that wound cultures were sterile, it was decided to suture the wound gradually in a timely fashion (two step closure, 3 and 4 weeks after admission) (Figure 3). Total

Figure 3 - A clean and granulated wound was gradually sutured in two steps.

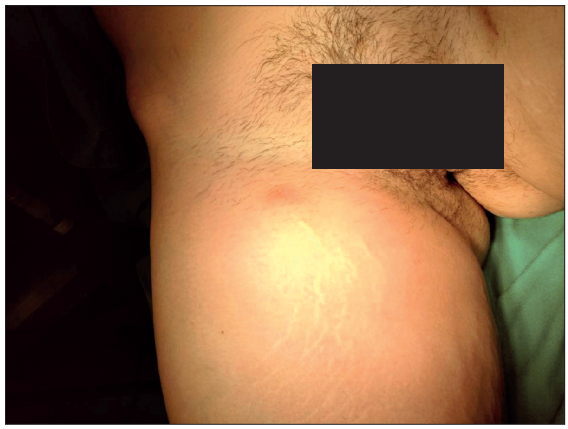

Figure 4 - Remarkable edema and signs of intravenous puncture of the right inguinofemoral region.

application of VAC was 26 days. The patient was discharged thereafter being hemodynamically stable and in good general condition with a total hospital stay of 28 days.

Case 2

The second patient was a 25 year old Caucasian female that was transferred to our Surgical Ward from a referring internal medicine department where she was under investigation for fever of unknown origin after a suspicious cellulitis of the right inguinofemoral region. The patient was an intravenous drug abuser, under antiepileptic medication, with HCV seropositivity. Physical examination of the affected limb revealed erythema, oedema and increased temperature of the affected limb (Figure 4) with pain out of proportion to the physical findings. Laboratory results revealed leukocytosis (21,34 x10^9/L), haematocrit 18%, haemoglobin 6,3 g/dL, platelet count 139 K/μL, INR 1,42, sodium 128 mEq/L, calcium 7,9 mEq/L, glucose 115 mg/dL, creatinine 1,4 mg/dL, CPK 1555 IU/L, albumin 2,3 gr/dL, C-reactive protein 167 mg/L. The calculated LRINEC score was 11. CT performed on day of admission showed diffuse areas of gaseous necrosis in the anterior and lateral femoral muscle compartments with overlying cellulitis and without obvious bone involvement.

She was subsequently taken for surgical debridement to the operating room. Myonecrosis involved the adductor brevis and longus, as well as part of the pectineus muscle (Figure 5). Tissue specimens and cultures were send to the Microbiology Department for further processing. A second debridement was done 48 hours later which helped the patient to achieve a stable status at the ward. The vacuum-assisted closure device (Simex 300, Simex Medizintechnik GmbH, Denmark) was then applied to the wound site as follows: continuous negative pressure -125 mmHg for the first week and, thereafter, in an intermittent fashion (-110

Figure 5 - Debridement of the adductor and pectineus muscles and application of the VAC device.

mmHg alternating to -80 mmHg). After follow-up CT scan revealed topical inflammation regression with concomitant normalization of inflammatory indices (post-admission CRP: 1 week 110 mg/L, 2 weeks 42,2 mg/L, 3 weeks 13,9 mg/L, 4-5 weeks 1,94 mg/L), cultures turned sterile, and the wound was primarily closed in two stages (5 weeks after her admission) (Figure 6). Total application of VAC was 32 days.

Antibiotic coverage included an initial empiric dosing of penicillin ($6x10^6$ IU QID, IV), clindamycin (600 mg QID initially, i.v.) and metronidazole (500 mg TID, i.v.) along with a short 3 day trial of an aminoglycoside (amikacin 1 g OPD, i.v.) since the patient's confirmed normal renal function allowed it. It was later modified to include fluconazole (200 mg OPD, i.v.) and meropenem (2 g TID, i.v.). The isolated miroorganisms were *Clostridium sordellii* and *Candida albicans*. The patient was discharged after 41 days of hospital stay.

DISCUSSION

Necrotizing soft tissue infections affect the skin, subcutaneous tissue, fascias and muscles and have a substantial morbidity ranging from 30 to 70% depending on whether the first surgical debridement is on time or late, respectively [1, 5-8]. The prompt and aggressive surgical debridement with removal of all necrotic tissues (even suspicious or borderline ones) and even including amputation of the affected limb is the sole most important factor affecting the clinical course of such patients, regardless of the infection's localization or the causative microorganisms. This requires an early diagnosis and a high index of suspicion. During the procedure itself, the surgeon must take into consideration the patient's life only and should not hesitate to proceed to more aggressive debridement if he deems it necessary irrespective of the reconstruction that will be necessary in the future [1]. Of two cases we present above, both followed an uneventful postoperative course without any motor or other deficits.

After the initial or additional surgical debridement, it is of utmost importance to support the failing organ/systems of the patients along with appropriate antibiotic coverage and wound care. Both our patients were closely monitored in our surgical ward and did not need admission to the ICU at any point during their hospitalization. Their initial empiric antibiotic coverage included high doses of penicillin G, clindamycin, and a 3rd generation cephalosporin. Additional aminoglycoside for 3 days was administered to the one whose renal function remained unaffected by the infection process. The antibiotics were changed accord-

Figure 6 - A clean and granulated wound was gradually sutured in two steps.

ingly after the receipt of the culture results. Further adjustments were made depending on the clinical course of the patients. Surgical wound care is critical and must always be made by the same group of surgeons who record the healing progress and infection remission and keep a thorough photographic record. The use of vacuum-assisted closure device was very effective since it promoted the granulation-healing process in both our patients leading to the definite stepwise wound closure by sutures. Femoral vessels were protected and covered by a protective sheath during all the course of VAC therapy.

The application of vacuum-assisted devices is nowadays a widely accepted and clinically effective treatment of complicated wounds with clear advantages including healing acceleration and contraction of the wound's size when compared to conventional wound care. The primary mechanisms of action of these devices are the following:

1) removal of excess wound fluid containing high levels of proteolytic enzymes and cytokines with restoration of vascular and lymphatic flow;
2) decreased bacterial load and increased granulocyte concentration (presumably related to foreign body reaction to the foam used to fill in the wound cavity);
3) mechanical stress causing granulation tissue formation and angiogenesis;
4) keratinocyte migration across the wound defect [10].

These devices are nowadays a widely accepted modality of complicated wound management with indications, contra-indications and step-by-step guides to their use. Complications are rare, and consist mostly of pain. A very rare reported complication is dehydration resulting from the removal of large quantities of exudate from the wound. However, the main argument against VAC device application is the cost efficiency, especially in the context of the present financial crisis. However, this does not seem to be the case when one compares the cost of the VAC versus the conventional wound dressing changes cost [10].

Moreover, VAC devices speed up the healing process when compared to traditional wound dressing care resulting in decreased hospitalization time and subsequently cost [9]. In a recent report of our experience of application of negative pressure for treatment of NSSTIs, we concluded that the use of VAC significantly shortened the length of hospital stay (mean 36 days) in comparison to traditional wound care (58 days) [11].

In conclusion, based on our experience and a review of the published literature, the use of vacuum-assisted closure devices in complicated wounds in patients with necrotizing soft tissue infections is successful in most cases and is accompanied with faster wound healing, decreasing the hospitalization costs and promoting the patient's mobility.

Keywords: Negative pressure wound therapy, vacuum-assisted closure, necrotizing soft tissue infections.

SUMMARY

Negative pressure wound therapy using vacuum-assisted closure (VAC) devices is currently a well established technique for managing complicated wounds. Such wounds occur after aggressive surgical debridement for necrotizing soft tissue infections (NSTI). In this report we present our experience in two intravenous drug abusers managed with VAC for NSTIs. The patients were 25 and 34 years old, HCV positive and presented with oedema of the upper femoral compartments and concomitant severe sepsis. Ultrasonography and computed tomography revealed severe cellulitis, fluid collection and necrosis of the affected fasciae and muscles. After emergent and subsequent aggressive surgical debridement during the first 48h, the VAC device was applied. Both patients had an uncomplicated postoperative course and a fast recovery from their multiorgan dysfunction. Suture closure of the wounds was achieved at the 25th and 38th postoperative days respectively and patients were discharged without any motor deficit. Negative pressure wound therapy is a modern therapeutic modality for treating complicated infected wounds. Moreover, it accelerates wound healing and primary closure, facilitating patient ambulation and recovery. A dedicated medical and nursing team is an important prerequisite for a successful outcome.

RIASSUNTO

*La terapia a pressione negativa con le unità terapeutiche VAC (*vacuum-assisted closure*) è una tecnica ben consolidata per la cura di ferite complicate. Questo tipo di ferite si possono osservare dopo lo sbrigliamento chirurgico aggressivo di infezioni necrotizzanti dei tessuti molli (INTM).*

In questo caso clinico vi presentiamo la nostra esperienza in due tossicodipendenti per via endovenosa con INTM che sono stati trattati con il sistema VAC. I pazienti, rispettivamente di 25 e 34 anni, erano HCV positivi e presentavano edema dei compartimenti superiori della coscia e concomitante sepsi grave. L'ecografia e la tomografia computerizzata hanno rivelato cellulite grave, raccolte di fluido e necrosi delle fasce e dei muscoli affetti. Successivamente agli sbrigliamenti chirurgici aggressivi effettuati in emergenza durante le prime 48h, la VAC è stata applicata. Entrambi i pazienti hanno avuto un decorso post-operatorio senza complicazioni e un recupero veloce dalla disfunzione multiorgano. La chiusura delle ferite è stata raggiunta, rispettivamente, dopo 25 e 38 giorni dall'intervento e i pazienti sono stati dimessi senza nessun deficit motorio. La terapia a pressione negativa è una modalità terapeutica moderna per il trattamento di ferite infette complicate. Inoltre, accelera la guarigione delle ferite, facilitando la deambulazione del paziente e il suo recupero. Un apposito team medico e infermieristico è un presupposto importante per il buon esito della terapia.

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