

LIMB SALVAGE USING LIVING BILAYERED CELL THERAPY AND NEGATIVE PRESSURE WOUND THERAPY: HEALING A PATIENT WITH NECROTIZING FASCIITIS OF THE FOOT AND LEG

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ABSTRACT

Problem: Necrotizing fasciitis (NF) is an advancing soft tissue infection characterized by widespread necrosis.

Rationale: NF requires rapid treatment and wound closure. Negative pressure wound therapy* (NPWT) promotes granulation tissue and reduces wound fluid. Living bilayered cell therapy* contains multiple growth factors/cytokines that are expressed in normal human skin which are essential for wound healing.

Methodology: A 71 year-old obese male presented from his PCP status post 4 days with a crush injury to the right foot, which had gotten progressively worse. Full thickness skin loss was evident (lateral foot/ankle). The devitalized tissue was debrided, the patient continued on cephalexin.

Results: Within 2 days there was ascending cellulitis. He was admitted to the hospital for an I&D/debridement and placed on vancomycin, piperacillin/tazobactam, clindamycin. Follow up x-rays revealed gas in the tissues (lateral side of the foot extending up the leg tissue planes). Extensive I&D/debridement was performed with a resultant wound (20cm x 10cm x 1.5cm), and exposed tendons/nerves. NPWT was used in preparation for a skin graft, which the patient subsequently refused. The patient was discharged from the hospital with a PICC line and IV antibiotics. Once the wound bed was clean and granular we utilized living bilayered cell therapy to close the wound and restore limb function.

Conclusions: The patient was at risk for limb loss secondary to a crush injury from NF. Utilizing surgery and advanced wound care (NPWT and living bilayered cell therapy) the patient healed without disability or loss of function.

BACKGROUND

- Necrotizing fasciitis is a progressive, rapidly spreading infection located in the superficial and deep fascial planes, with secondary necrosis of the subcutaneous tissues. Due to the presence of gas-forming organisms, subcutaneous air is often noticed on x-ray. The speed of spread is directly proportional to the thickness of the subcutaneous layer. Necrotizing fasciitis moves along the deep fascial plane, therefore requiring rapid treatment and wound closure of the resultant wound.
- Negative pressure wound therapy* (NPWT) delivers an intermittent or continuous delivery of negative pressure by utilizing a controlled application of sub-atmospheric pressure to the wound. This negative pressure helps promote granulation tissue and reduces wound fluid.
- Living bilayered cell therapy* consists of a living, active dermal layer which combines human fibroblasts in a bovine type 1 collagen matrix, which are able to produce additional matrix proteins. The active epidermal layer is formed by promoting human keratinocytes first to multiply and then to differentiate to replicate the architecture of the human epidermis. Together the cellular crosstalk between these two layers is able to produce and deliver multiple growth factors, and structural proteins essential for wound healing.

*Negative pressure wound therapy: V.A.C.® device. Kinetic Concepts, Inc., KCI.

*Living bilayered cell therapy: Apligraf®. Novartis. ©2006 Organogenesis Inc.

CASE HISTORY

- A 71 year-old obese, non-diabetic male presented from his Primary Care physician status post 4 days with a crush injury to the right foot, which had gotten progressively worse. The cause of the injury was a result of a motor vehicle backing up onto his foot.
- The patient was placed on cephalexin and instructed to use crutches as he was unable to bear weight on the foot. Patient denied fever, chills, shortness of breath, chest or calf pain. He noted that his right foot had gotten progressively more swollen and red and developed large blisters and torn skin.
- Upon exam, the patient was afebrile and in no apparent distress. Vascular status was intact with no evidence of ischemia or cyanosis of digits. The right foot was warm and erythematous. A large area of full thickness skin loss was evident at the lateral foot and ankle with devitalized tissue. A large bulla was noted on the dorsum of the foot. Ecchymosis was noted throughout the foot and ankle. Neurologic exam was unremarkable. There was no evidence of fracture or dislocation on x-ray or upon physical examination.
- Sharp debridement of devitalized tissue was performed and tissue was sent for culture and sensitivity. Patient remained on the cephalexin awaiting culture results. Patient was placed non-weight bearing and sent for an MRI, which was negative for fracture, dislocation or joint effusion. Subcutaneous hemorrhage was present in several areas within the peroneus longus and brevis tendon.
- The patient returned to the office 2 days later with worsening wounds, tissue loss and foul odor. Although the damaged tissues appeared more ischemic, neurovascular status remained unchanged. Ascending cellulitis was noted with rapid progression. The patient was admitted to the hospital for IV antibiotics, debridement, incision and drainage, in addition to consults with Infectious Disease and Vascular Surgery.

PROCEDURE/RESULTS

- Following vascular/medical clearance the patient was taken to surgery for an incision and drainage (I&D) with debridement, removal of necrotic tissue and exploration of tunneling areas of necrosis was performed. The wounds were packed open and the wounds were flushed twice daily with antibiotic saline and packed.
- Despite surgery and local wound care, the area continued to worsen and the patient became febrile and the white count remained elevated. Erythema and edema continued to progress over several days and the skin became progressively devitalized and darkened. Pain was also worsening and the patient required stronger pain medications.

LAB WORK

- White blood count: 13,000cmm (normal range: 4,300 - 10,800cmm)
- Platelets: 553 x10⁹/liter (normal range: 150 - 400 x10⁹/liter)
- ESR: 43mm/hr (normal range males 50 years old: 0 - 20mm/hr)
- Blood Cultures: negative
- Venous Doppler: Negative for DVT

ANTIBIOTIC COVERAGE

- Vancomycin
- Piperacillin/tazobactam
- Clindamycin

PROCEDURE/RESULTS (cont.)

- X-rays revealed the presence of gas in the tissues on the lateral side of the foot extending up the tissue planes of the leg. (Figures 1 & 2) The patient was advised of the nature of necrotizing fasciitis and was informed that he was at risk for limb loss even with treatment.
- The patient was taken back to surgery and extensive I&D was performed starting just proximal to the digits and extending proximally along the dorsal and lateral foot and lateral compartment of the lower leg. The resultant wound was approximately 20cm x 10cm x 1.5cm. There were exposed superficial nerves as well as tendon exposure. Following local wound care the wound was reduced to approximately 18.5cm x 7.5cm x 1.2cm. (Figure 3)



Figures 1 & 2. 06/23/05: Presence of gas in the tissues on the lateral side of the foot extending up the tissue planes of the leg

- NPWT was used to decrease the wound size, increase granulation tissue, remove interstitial fluid/infectious material and increase granulation tissue in order to maintain a moist wound environment in preparation for a skin graft. Upon the plastic surgery consult, the patient refused the skin graft procedure. Following several weeks of local wound care the patient responded well and was eventually released from the hospital with a PICC line and IV antibiotics and was followed at the Wound Center.
- The patient's cellulitis continued to resolve with 2 weeks of outpatient IV antibiotics and wound care. Once the wound bed was clean and granular the NPWT was discontinued. The wound appeared free of infection. Advanced wound care was continued and on 7/26/05, the patient received the first of 2 applications of living bilayered cell therapy. (Figure 4)
- The patient continued to heal well without infection. (Figure 5) His dressings included a silver impregnated contact layer and a 4-layer compression bandage. The patient developed some local dermatitis around the wound site which was treated. A second application of the living bilayered cell therapy was performed on 8/30/05.



Figure 3. 07/06/05: Following local wound care the wound measured 18.5cm x 7.5cm x 1.2cm



Figure 4. 07/26/05: Wound appearance prior to application of the living bilayered cell therapy. Wound measured 18cm x 7.4cm x .6cm

- The patient continued to be seen in the Wound Center weekly. The patient went on to complete healing without any disability. He did not require an autogenous skin graft and he did not suffer limb loss or significant loss of function. (Figure 6)



Figure 5. 08/02/05: Appearance of the wound status post 1 week application of the living bilayered cell therapy



Figure 6. 11/02/05: Complete healing and remodeling

CONCLUSIONS

- Necrotizing fasciitis represents an aggressive medical/surgical emergency. It is typically characterized by an insidiously advancing soft tissue infection characterized by widespread fascial necrosis.
- Prompt recognition along with an appropriate care management plan is essential.
- Treatment often requires an interdisciplinary approach in order to obtain optimal results.
- Due to the complexity of this condition prompt treatment in the form of debridement, antibiotic coverage and advanced wound care is paramount.
- The timely utilization of sub-atmospheric pressure dressings was able to reduce the wound fluid and prepare the wound for closure.
- Complete wound closure was achieved with the application of living bilayered cell therapy, which delivers multiple growth factors and matrix proteins that facilitate the healing process.

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