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Alternative Method for Soft Tissue Preservation in the Treatment of Necrotizing Fasciitis Using External Fixation Material and Vacuum Therapy: A Case Report

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Abstract

Background: Necrotizing fasciitis is a rare but life-threatening infection, frequently caused by group A streptococcus (GAS), which requires timely diagnosis and urgent medical treatment. Surgical intervention consists of removing all the affected tissue, as well as preservation of skin tissue to prevent excessive mutilation. In this case report we describe a method to minimize the mutilation by using external fixation material, with favourable outcome.

Case description: A 33-year old man with necrotizing fasciitis of his left arm, caused by group A streptococcus (GAS), was treated successfully with the use of external fixation material to open up all the muscle compartments while remaining a sufficient amount of skin for secondary skin closure. When sufficient control of the infection was accomplished, tie-wraps in combination with vacuum therapy were applied to establish secondary skin closure. By using the external fixation for preservation of the skin, the amount of scar tissue was minimal when considering the severity of the primary infection.

Conclusion: In case of necrotizing fasciitis to an extremity, the use of external fixation material with vacuum therapy could enhance the treatment, preserving sufficient skin for secondary wound closure and restoration of limb function. In this way, the morbidity of necrotizing fasciitis can be minimized.

Necrotizing fasciitis is mainly caused by a monomicrobial infection with group A streptococcus (GAS) or Staphylococcus aureus. Polymicrobial necrotizing infections are caused by a combination of aerobic and anaerobic bacteria [2].

Necrotizing fasciitis is a rare but life-threatening infection, with high mortality and morbidity. The exact incidence is hard to determine due to the use of varying terminology in clinical practice, but estimated rates are 4.2/100.000 necrotizing soft tissue infections in the United States per year [3]. Factors that increase the risk of developing necrotizing fasciitis are, among other parameters, skin lacerations, recent surgery, immunosuppression, obesity and alcoholism [4]. Rapid diagnosis is life saving and can prevent systemic toxicity and limb loss. Guidelines state that urgent aggressive surgical treatment with broad antibiotic therapy and hemodynamic support is the only curative treatment [5,6].

Surgical treatment consist of removing all the affected tissue, but on the other hand attempting to preserve as much skin as possible to prevent excessive mutilation. This balance can be hard to accomplish in the acute setting and subsequent surgical are common due to rapid spreading of the infection. Initial medical treatment should consist of broad spectrum antibiotics and should include carbapenem or piperacillin-tazobactam, Clindamycine and an agent with activity against methicillin-resistant S. Aureus (MRSA) [7]. Acute surgical exploration can result in large skin defects and excessive plastic surgical procedures can be necessary to reduce morbidity, and increase functionality of the affected body part.

Keywords: Necrotizing fasciitis; External fixation; Vacuum therapy

Introduction

Necrotizing fasciitis is a rapidly spreading infection and involves primarily the muscle fascia. Due to the poor blood supply of the fascia, infection is rapidly spread along this fascia without affecting the muscle itself [1]. Infections can be divided into two categories: monomicrobial and polymicrobial.

Case Description

A healthy 33-year old man with no prior medical history other than an episode of depression for which he did not use any medication, was referred to the Emergency Department (ED) his General Practitioner. He felt sick for the past ten days. During the ED visit his temperature was 39.5 degrees Celcius (103 Fahrenheit). He had pain in his left arm, which was swollen and showed erythema. No neurological or vascular abnormalities were observed in the arm. Laboratory results showed increased

infection parameters (leukocytes $16.3 \times 10^9/L$, C-Reactive protein 423mg/L).

There was a suspicion of necrotizing fasciitis and subsequent MRI-scan confirmed that the left arm had multiple fluid collections with expanding oedema of subcutaneous fat tissue (Figures 1 and 2).



Figure 1: MRI transverse image. In this setting fat tissue is being suppressed, so it should be dark (as visible at the thorax). With this patient the subcutaneous fat tissue was very hyperdense, which is a sign of expanded oedema. There is also a fluid collection visible on the lateral side of the biceps muscle.

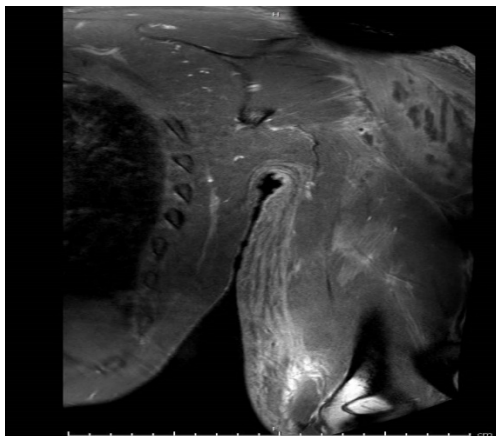


Figure 2: MRI frontal image. In this setting fluids are being suppressed, so they appear darker. With this patient multiple hypodense lesions are visible in the deltoid muscle, which is a sign of fluid collections.

After confirmation of the diagnosis necrotizing fasciitis multiple intravenous antibiotics (penicillin, doxycycline and clindamycin) were administered on the ED.

The patient was transferred directly to the Operation Room (OR). All muscle compartments in the lower and upper left arm were surgically explored, from which purulent fluid was evacuated and all visibly affected tissue was removed. Cultures were obtained previous to extensive lavage of the soft tissues.

Postoperatively, the patient was admitted to the Intensive Care for further observation, hemodynamic support and antibiotic treatment. After two days the cultures appeared positive for group A streptococcus (GAS), and antibiotic therapy was narrowed specifically onto this bacteria. During the following week, three subsequent surgical explorations were performed, with drainage of new purulent fluid collections in the several muscle compartments. These new collections were caused by closed areas that were created when non-affected skin was put back in place. During the fourth inspection the importance of an alternative method became clear, when new fluid collections were found. Instead of removing unaffected skin to keep the several compartments open, external fixation material was placed through the bony structures of the arm, and the non-affected skin was attached to the external fixation bars (Figures 3 and 4) to keep the several muscle compartments open and to prevent new fluid collections.

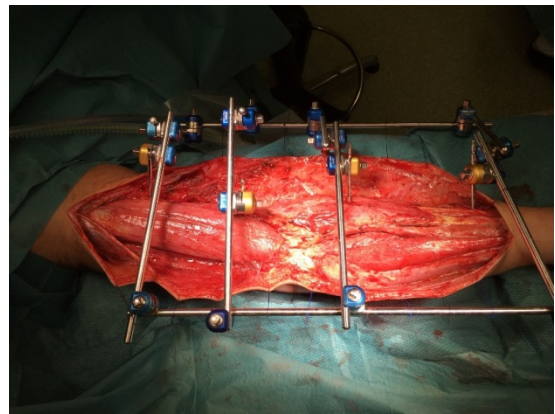


Figure 3: Application of external fixation in OR, close-up.

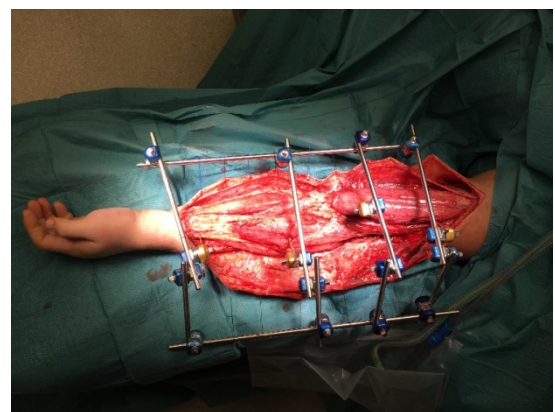


Figure 4: Application of external fixation in OR, full view.

Due to this method, the affected areas were easily inspected and the non-affected skin kept preserved for secondary skin closure.

Due to this method, the affected areas were easily inspected and the non-affected skin was preserved for secondary skin closure. During the fifth surgical inspection, eleven days after his admission, the infection was sufficiently treated and the

external fixation material was removed. Vacuum therapy was applied to improve wound granulation, combined with the use of tie wraps decreasing the wound size, to establish secondary wound closure (Figures 5-8).



Figure 5: First time application of vacuum sponge with tie-wraps.



Figure 6: First time application of complete vacuum system.



Figure 7: Last time application of vacuum sponge with tie-wraps.



Figure 8: Last time application of complete vacuum system.

Nineteen days after initial admission the skin defect was decreased to such measures that definitive wound closure was possible. One month after discharge the man had a fully healed scar and regained complete functionality of his left arm (Figures 9 and 10).



Figure 9: End result in extension frontal side, one month after discharge.



Figure 10: End result in flexion, one month after discharge.

Discussion

Necrotizing fasciitis is a rapidly spreading infection with severe mortality rates, estimated at 24% despite adequate treatment [8]. Timely recognition and adequate treatment is essential for survival. Aggressive surgical excision of the affected tissue can result in mutualizing tissue defects. The use of controlled negative pressure (vacuum) therapy is well known to improve wound granulation and optimize secondary wound closure [9]. Often, in addition to vacuum therapy, extensive plastic surgical reconstruction is necessary to establish final coverage of skin defects. Complete functionality of a limb after necrotizing fasciitis is rare and often (partial) limb amputation is necessary [10]

In this case, external fixation material is used to prevent the formation of new fluid collections and therefore control of the infection. Furthermore, compartment inspection was easily facilitated. The use of external fixation material is well known in trauma surgery for reposition and fixation of bone fractures. But has never been described in facilitating the treatment of necrotizing fasciitis [11]. During early treatment, the use of Vacuum therapy was contra-indicated due to exposed blood vessels, the amount of loose skin tissue and the size of subcutaneous cavities. Vacuum therapy could result in secondary skin necrosis. After control of the infection, the subcutaneous cavities were closed by replacing the skin and blood vessels were covered.

The number of patients treated for necrotising fasciitis using this method is very limited. Inserting a metal pin into bone in an infected area is risky, but external fixation is commonly used in the treatment of trauma patients with contaminated fractures. Furthermore, the risk of creating osteitis at the pin tracks is limited due to the great amount of antibiotics administered during the treatment of necrotizing fasciitis

Conclusion

This case report demonstrates the use of external fixation material followed by vacuum therapy to enhance the treatment

of necrotizing fasciitis and reduce skin defects which can result in the loss of function in the affected limb. In this way the morbidity of necrotizing fasciitis can be minimized.

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