CASE REPORT


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SUMMARY

Background: To explore the comprehensive treatment of group A streptococcus haemolyticus complicated with streptococcal toxic shock syndrome (STSS) in surgery.

Methods: Six patients with Type II necrotizing fasciitis complicated with STSS were enrolled from September 2018 to October 2019 in the Burn Department at Quanzhou First Hospital. The patients were treated with early incision and reduction of tension, anti-shock, anti-infection, primary debridement and vacuum suction, maintenance of organ function, and adjustment of internal environment, secondary autologous skin graft, and early rehabilitation.

Results: Five patients were healed, while one elderly patient refused treatment.

Conclusions: We should be alert to necrotizing fasciitis caused by group A hemolytic streptococcus (GAS) infection and effectively avoid the occurrence of STSS. By making an incision to reduce tension, adopting the principle of anti-infection, and actively anti-shock, maintaining the function of internal organs and the stability of internal environment, debridement and vacuum suction in early and effective stage, followed by self-skin graft to seal the wound and early rehabilitation the treatment of Type II NF and STSS can be effectively improved.


KEY WORDS
type II necrotizing fasciitis streptococcal toxic shock syndrome (STSS), group A hemolytic streptococcus (GAS), vacuum sealing drainage (VSD)

INTRODUCTION

Necrotizing Fasciitis (NF) is a complex skin and soft tissue infection that develops very rapidly and is often life threatening [1]. According to the species of pathogenic bacteria, NF was divided into type I, type II, and type III. Type II is caused by a single group A hemolytic streptococcus (GAS) infection [2], which commonly leads to toxic shock, multiple organ dysfunction, and/or even organ failure and is called streptococcus-related toxic shock syndrome (STSS) in clinic [3]. From September 2018 to October 2019, at the Burn Department
in Quanzhou First Hospital China, we treated 6 patients with Type II necrotizing fasciitis and STSS. After confirming the diagnosis, the affected limb was cut open to reduce tension, followed by anti-infection, anti-shock treatment to maintain the function of internal organs and maintain the stability of internal environment. The early effective wound debridement and vacuum sealing treatment, and later on free skin grafting to repair the wound, strengthening the early rehabilitation, together with other comprehensive treatments have achieved satisfactory results.

**MATERIALS AND METHODS**

**Clinical Data**

Six patients with Type II necrotizing fasciitis complicated with STSS were enrolled from September 2018 to October 2019 at Burn Department in Quanzhou First Hospital China. There were five males and one female. Age Range: 22 - 89 years old, average 52.00 ± 23.10 years old. Pre hospital treatment time: 26 - 62 hours, average 38.83 ± 14.34 hours. Causes: 3 cases were due to diabetic infection, 2 cases were due to gout and skin infection, 1 case was due to infection after skin injury. The distribution of the injured area: 5 cases with lower limbs and 1 case with upper limbs. The area of lesion accounts for 2.5% - 6% of the total surface area, with an average of 3.50 ± 1.30%.

**Clinical Manifestation**

Six patients all had early local skin swelling and pain, and their body temperature fluctuated between 38.5°C and 39.7°C. The disease development was rather rapid. Within 24 hours, the lesion has spread to the surrounding tissues. The swelling and progressive aggravation of the affected limb resulted in tension blister and blood blister, and then the damaged skin became purple, black and foul. The patients’ general conditions were restlessness, thirst, increased heart rate, decreased blood pressure, reduced urine output, and other shock manifestations.

**Lab Results**

In this group of patients, WBC, CRP, and PCT were significantly increased and accompanied with severe hypoproteinemia and intrahepatic cholestasis, with 5 cases of liver function damage, 4 cases of creatinine, urea nitrogen, and water electrolyte disturbance, and 2 cases of respiratory and circulatory failure. GAS was cultured for wound etiological examination. The results of drug sensitivity indicated resistance to erythromycin, clindamycin, and tetracycline, while sensitive to penicillin, cefotaxime, vancomycin, and linezolid. Necrotic fascia was found in 2 patients with purulent histopathology.

**Anti-shock, reduction of limb incision, anti-infection, support, and other treatment**

All of the 6 patients were in shock at the time of admission. Crystalloid and colloid fluids were given alternately to fight shock, as well as vasoactive agents (dopamine, (-)-noradrenaline) to maintain organ blood. Limb swelling, tension blisters, and blood blisters was observed. In order to reduce tension, emergency bedside incision was performed up to the deep fascia layer, and the muscular membrane layer was cut open to completely release tension. Anti-infection medication was started: we used a combination of linezolid meropenem and metronidazole as early empirical therapy, and switched to the sensitive antibiotics later on according to the lab findings. We also actively worked on maintaining the balance of water and electrolytes, stabilizing the internal environment, correcting hypoproteinemia, and overall improving the nutritional status of the whole body. As a result, we actively managed the perioperative period and established a good foundation for the follow up wound debridement and later on wound closure.

**Stage one debridement and closed negative pressure suction**

The wound debridement was performed by a water jet scalpel technology debridement system within 72 hours of admission. During the operation, the subcutaneous fat showed taupe liquefying necrosis, most of the fascia tissue showed yellow and white "cheese like" necrosis, and there was visible embolized vascular network and some muscles showed macular necrosis. At the cutting edge, there was no contraction of the muscle, but there was a large amount of dark red viscous pus with irritating odor. All the necrotic tissue was completely removed and the inter ecological tissue was properly preserved. The operation range was extended to only 5 cm above the normal fascia. A large amount of 3% hydrogen peroxide solution, normal saline, 0.1% iodine solution, and biological dressing with active factors were used to irrigate the wound repeatedly. When the hemostasis was stable, the negative pressure suction material (VSD) was used to cover the wound, deep tissue, and cavity without leaving a dead cavity. Silica gel drainage tube and washing tube were retained, and the VSD material and surrounding normal skin were sealed with semi permeable membrane to form a closed wound, which was installed under negative pressure. Check the closed wound after placement to ensure smooth drainage and no air leakage. After the operation, the negative pressure of 20 - 40 kpa was used for continuous suction, and normal saline (40 mL of active factor biological dressing was added to every 500 mL) was used for continuous drip wash. The wound was kept in a wet environment to ensure full drainage and to avoid the blocking of the drainage tube. According to the condition of the wounds, VSD should be replaced once in 7 - 12 d if necessary.
Necrotizing Fasciitis Shock Syndrome by Group A Hemolytic Streptococcus

Table 1. Comparison of infection indexes (WBC, PCT, and CRP) before and after treatment.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>WBC (10⁹/L)</th>
<th>CRP (mg/L)</th>
<th>PCT (ng/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>6</td>
<td>30.07 ± 4.98</td>
<td>172.97 ± 22.64</td>
<td>9.65 ± 1.77</td>
</tr>
<tr>
<td>After</td>
<td>6</td>
<td>12.08 ± 3.05</td>
<td>37.16 ± 7.36</td>
<td>1.97 ± 1.00</td>
</tr>
<tr>
<td>p-value</td>
<td></td>
<td>&lt; 0.05</td>
<td>&lt; 0.05</td>
<td>&lt; 0.05</td>
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</tbody>
</table>

Table 2. Comparison of organ function indexes before and after treatment.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>BUN (mol/L)</th>
<th>Cr (µmol/L)</th>
<th>ALB (g/L)</th>
<th>TBL (µmol/L)</th>
<th>DIBL (µmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>6</td>
<td>9.95 ± 1.00</td>
<td>182.17 ± 36.89</td>
<td>20.47 ± 1.52</td>
<td>83.90 ± 11.48</td>
<td>51.10 ± 9.54</td>
</tr>
<tr>
<td>After</td>
<td>6</td>
<td>4.68 ± 1.17</td>
<td>76.17 ± 20.16</td>
<td>33.00 ± 1.88</td>
<td>30.77 ± 8.26</td>
<td>12.83 ± 7.49</td>
</tr>
<tr>
<td>p-value</td>
<td></td>
<td>&lt; 0.05</td>
<td>&lt; 0.05</td>
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Repair of closed wound with autogenous skin grafts
If there is still edema and aging of residual necrotic tissue or granulation tissue in the wound, VSD materials should be replaced after debridement, and continuous irrigation and drainage should be performed after the operation. If the patient condition was stable, VSD materials were removed. When VSD material is removed, granulation tissue has grown, blood supply is abundant, and wound bed is well prepared, then large pieces of thick skin from patient self can be taken for transplantation to repair and seal the wounds.

Postoperative treatment and rehabilitation
According to the foundation, infection, and patients’ overall conditions, the first dressing change should be performed 3 - 5 days after the operation. It is important to understand the condition of the operation area and skin, to select sensitive antibiotics, and to provide nutritional support and symptomatic treatment. If the condition allows, early bed rest or getting out of bed for functional rehabilitation training is critical to prevent muscle, tendon contracture and joint stiffness, which can also effectively promote limb blood circulation and prevent deep vein thrombosis.

RESULTS

Five out of six patients in our study group were cured. One elderly patient gave up treatment. Length of hospital stay was 32 - 51 days, average 41.2 ± 7.3 days. There was no recurrence found during 3 months follow-up. After incision and decompression, anti-infection, early debridement, and negative pressure suction, the infection indexes (WBC, PCT, and CRP) decreased significantly (Table 1), and the organ function improved significantly (Table 2). Before and after treatment, there was significant improvement in each index (p < 0.05). The skin grafts of all 5 patients survived well and the wounds were completely closed. At the 3-month follow-up, the scar hyperplasia was not obvious in the operation area, the function and activity of the affected limb were basically normal, and the appearance was satisfactory.

DISCUSSION

In clinical practice, GAS infection is very common, which is often manifested as complex skin and soft tissue infection in adulthood [4]. It is not unusual to be complicated with “streptococcal toxic shock syndrome” (strep TSS) without effective treatment. About 70% of the patients developed into type II necrotizing fasciitis, which is characterized by severe infection of deep tissue, muscle necrosis, and difficult critical conditions [5]. In this study, six cases were diagnosed as type II NF with STSS. Patients’ conditions worsened rapidly and presented as organ dysfunction or even organ failure in a short period of time. There were 5 patients with intrahepatic cholestasis and liver injury, 4 patients with renal insufficiency, and 2 patients with respiratory and circulatory failure. It has been reported that the death rate of patients with GAS infection complicated with STSS is as high as 52% [6]. All 6 patients in our study group have been successfully treated with active surgical intervention and other comprehensive treatment. Gout, diabetes, tumor, autoimmune disease, and other causes of body’s low immune function are high-risk factors for inducing NF. It has been reported that the proportion of NF with diabetes is as high as 60% [7]. Also, gout patients often lead to NF from infection induced by gout nodule rupture [8]. In this study group, there were 2 patients with diabetes mellitus and gout. The local
Representative Case
Yu, male, 39 years old, was hospitalized for 18 hours due to left lower limb necrosis and shock.

Figure 1. A, B, C. The wounds were located in the left lower limb, involved about 6% of the total body surface area. The base of the wound was black and damp. The wound margin was irregular, and the wound surface was red and swollen. The tension of the left lower limb was high, and there were tension blisters and blood blisters. The wound inflammation zone has spread to the midline of abdomen, to the left upper abdomen and to the left hypochondrium.

Figure 2. D, E, F. In the Emergency Room, line incision and tension reduction were performed. There was gray-brown liquefied necrosis of the subcutaneous fat of the left lower limb, and liquefied necrosis of the deep fascia. Also, some muscles showed necrotizing myositis. Most of the necrotic tissue was removed and followed up with histopathologic examination.

Figure 3. G, H. Hematoxylin-Eosin staining 100 x: Pathological section of necrotic tissue showed that there was massive neutrophil exudation with tissue necrosis and pus formation. There are scattered necrotic muscle fibers. The fresh necrosis is homogeneous, and the old necrotic muscle fibers are infiltrated by inflammatory cells.
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Figure 4. I. During stage one treatment, necrotizing myositis was seen in the left lower extremity, and the sarcolemma was opened to show the gracilis, biceps femoris. The gastrocnemius of the left thigh showed "sandwich like" necrosis. The aponeurosis and Achilles tendon of gastrocnemius were partially exposed after debridement.

J. After the left lower limb was debrided and the necrotic tissue was removed, the left lower limb was covered with VSD dressing and a drainage tube was placed, with continuous irrigation and drainage by negative pressure suction.

K. Ten days after debridement and vacuum suction treatment of the left lower extremity, the wound of the left lower extremity was covered with fresh granulation tissue, and the blood supply was so rich that it bled easily. The wound surface is ready for skin graft.

Figure 5. L. On the 5th day after skin grafting, the skin graft was in place, there was no abnormal effusion under the skin, the color was ruddy, the survival of the skin graft was good, and the wound of the left lower extremity was basically closed.

M, N. On the 6th month after skin grafting, wound of the left lower limb was healed with no recurrence. Left lower limb had good activity with satisfactory appearance.

Skin infection spread rapidly in a short period of time, followed by multiple organ damage such as heart, liver, and kidney, which may be related to the low immunity of patients due to long-term oral NSAIDs intake.

The early clinical manifestations of type II NF are often not clear. The onset of NF is quite insidious, easy to be missed, or even misdiagnosed. In the early stage, local swelling and pain, erythema, and elevated skin temperature are often seen. The skin lesions spread fast, and the swelling worsens rapidly. Tension blisters and blood blisters are typical manifestations in the middle and late stage [9]. If tension blisters and blood blisters appear in clinical practice, they should be cut and dilated early, which can effectively improve peripheral blood circulation, reduce muscle necrosis, facilitate drainage, and control infection [10]. The key to the effective control of the disease is to reduce the infection index and improve the organ function. Meanwhile, anti-infection treatment is also key to NF management. When toxic shock symptoms appear, if the type of bacterial infection is not clear, it is recommended to use a step-down therapy [11]. With the help of pathology lab on finding the causing pathogen and drug sensitivity test, we can avoid blind drug usage, effectively reducing drug resistance rate and reducing the side effects.

Numerous necrotic tissues and unclear boundaries are
CONCLUSION

In this group of cases, type II NF with STSS caused by GAS infection developed rapidly and patients’ conditions were critical. We should raise awareness in clinical work to avoid its development. Early and effective identification and diagnosis, timely incision to reduce tension, anti-infection, and effective debridement of wound by waterjet technology are the key points of successful treatment. VSD negative pressure suction treatment, autologous skin graft, combined with comprehensive support treatment and early rehabilitation greatly benefit wound repair and thus improve the success rate of treatment.

Declaration of Interest:

The authors have no conflicts of interest to disclose.

References: