Review Article

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Guidelines in Management of Necrotising Fasciitis

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Abstract

Necrotising fasciitis is a infection of subcutaneous tissue and fascia which may spread fulminantly to deeper tissues and wider tissues may cause damage severe damage to the tissues and present as a localised infection and fulminant septic shock with high mortality rate. In this Review, we will discuss about the current understanding and various guidelines in management of necrotising fasciitis.

Keywords: Necrotising fascitis; Guidelines; Surgical interventions.

INTRODUCTION

Necrotizing fasciitis is a frequent acute infection that affects people all over the world. The infection is usually caused by a post-traumatic, immuno-compromised patient. Edema and necrosis of subcutaneous tissues with involvement of neighbouring fascia, as well as painful red puffy skin over afflicted areas, are signs of a severe soft tissue infection caused by bacteria. Clinical symptoms of fulminant tissue destruction, systemic signs of toxicity, and significant mortality define these illnesses. Early surgical intervention and antibiotic medication are required for accurate diagnosis and proper treatment. We shall evaluate the role of several guidelines in the management of necrotizing fascitis in this review study.

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BACKGROUND

Hippocrates initially characterised Necrotising fasciitis about 500 BC, when he presented a clinical description of an erysipelas illness consequence that resembled the current description of Necrotising fasciitis. In 1783, Claude Colles, chief surgeon of the Hotel Dieu in Lyon, described a condition that resembled modern descriptions of necrotizing fasciitis.[1,2] Joseph Jones, a military surgeon in the Confederate States of America's army, was the first to describe contemporary Necrotising fasciitis. In 1883, Jean Alfred Fournier described a situation in which five males developed necrosis of the perineum; this kind of necrotizing fasciitis was named after him and is today known as Fournier's gangrene.Meleney found a link between beta-hemolyticstreptococcus A and a series of hospitalised cases in Beijing in 1924. Meleney's gangrene was the name given to these patients for several decades after that. Wilson proposed the term "necrotizing fasciitis" as a more precise description of this condition in 1952. The condition

was popularised as "flesh-eating bacterium syndrome" by the media.

AETIOLOGY AND RISK FACTORS

All standards imply trauma as the most common identifiable aetiology. The majority of patients had had minor or major traumas in the past, most of which were external injuries and surgical wounds. Among the most common causes of complicated intra-abdominal infections that can lead to Necrotising fasciitis are appendicitis with perforation, infection following the repair of an incarcerated hernia, perforated diverticulitis, necrotic cholecystitis, gastro-duodenal perforation, small bowel perforation, and obstructive colon cancer with perforation. The incidence of necrotizing fasciitis caused by a surgical wound in the chest wall is higher than that of similar wounds in the lower abdomen wall. Such situations carry a high risk of osteomyelitis, which raises the patient's mortality rate significantly. Perianal abscess, surgical wounds, skin abscess drainage, and pressure sores are all common causes of Fournier's gangrene. Anorectal infection, ischiorectal abscesses, and colon perforations can all cause it as a consequence of colorectal illness. Another cause could be a urethral stricture or a trauma caused by an indwelling Foley catheter. It's frequently linked to Bartholin abscesses or vulval skin infections in women. In Asia, Necrotising fasciitis can be caused by eating raw or undercooked seafood or being bitten by fish fins.[2,3]

Risk factors for Necrotising Fasciitis Include

- Major penetrating trauma.[2,3]
- Minor laceration or blunt trauma (muscle strain, sprain, or contusion)
- Skin breach (varicella lesion, insect bite, injection drug use)
- Recent surgery (including colonic, urologic, and Gynaecologic procedures as well as neonatal circumcision)
- Mucosal breach (Haemorrhoids, rectal fissures, episiotomy)
- Immunosuppression (diabetes, cirrhosis, neutropenia, HIV infection)
- Malignancy
- Obesity
- Alcoholism
- In women: pregnancy, childbirth, pregnancy loss, gynecologic procedures

Types of Necrotising Fasciitis

Necrotising Fasciitis will be divided into four types based on the guidelines.[1,2,3]

Table 1: Types of Necrotising fascitis.

Types	Organisms	Regions Involved	Comorbids
I (Polymicrobial)	Obligate and facultative anaerobes	Trunk and perineum	Diabetes mellitus
II (Monomicrobial)	GroupA-beta haemolytic streptococcus		
III	Gram negative bacteria	Limbs , Trunk	Post traumatic
IV	Candida, Zygomycetes	Limbs, Trunk, perineum	Immunosuppression

Necrotising fasciitis is a type of infection caused by bacteria such as Vibrio spp. and Aeromonashydrophila, which are widely found in raw seafood and are referred to as "marine bacteria."

SIGNS AND SYMPTOMS

Clinical manifestations of necrotizing infection include.[2,3,4]

- Erythema (without sharp margins; 72%)
- Edema that extends beyond the visible erythema (75%)
- Severe pain (out of proportion to exam findings in some cases; 72%)
- Fever (60%)
- Crepitus (50%)
- Skin bullae, necrosis, or ecchymosis (38%)

Fever (102-105°F), tachycardia, and systemic toxicity are all possible side effects. Hypotension may be apparent at first or develop as the infection progresses. Malaise, myalgia, diarrhoea, and anorexia are some of the other symptoms. Gas is frequently discovered in the deep tissues of these mixed infections, much as it is in clostridia infections. Clostridium perfinges, Clostridium septicum, Clostridium histolyticum, and Clostridium novyi produce gas gangrene, which is a rapidly progressing infection.[2,3]

DIAGNOSIS

The results of laboratory tests are usually nonspecific. Acidosis, coagulopathy, hyponatremia, raised inflammatory markers (C-reactive protein and/or erythrocyte sedimentation rate), and

elevations in serum creatinine, lactate, creatine kinase (CK), and aspartate aminotransferase (AST) concentrations are some of the abnormalities that can occur.[2,3] Increased serum CK or AST levels indicate a deep infection involving muscle or fascia (as opposed to cellulitis). NSTI cannot be consistently predicted using laboratory measures, especially in the early stages of infection. The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score[4] was developed using laboratory indicators such as white cell count, haemoglobin, sodium, glucose, creatinine, and C-reactive protein. Blood cultures are positive in about 60% of patients with monomicrobial (type II) necrotizing fasciitis caused by GAS or other beta-hemolytic streptococci, and they are consistently positive in necrotizing myositis patients. Blood culture yields are lower in patients with polymicrobial (type I) necrotizing fasciitis; in one study, it was just 20%. Furthermore, blood culture findings may not accurately reflect all organisms present.

LRINEC SCORING4

Table 2 : Lrinec Scoring.

Laboratory Risk Indicator for Necrotizing Fasciitis

CRP (mg/dL)	<15	0
	≥15	4
WBC (per mm3)	<15	0
	15-25	1
	>25	2
Hemoglobin (g/dL)	>13.5	0
	11-13.5	1
	<11	2
Sodium (mEq/dL)	≥135	0
	<135	2
Creatinine (mg/dL)	≤1.6	0
	>1.6	2
Glucose (mg/dL)	≤180	0
	>180	1
Composite Score	Score < 6	Low Risk
	Score 6-7	Intermediate
	Score ≥8	High Risk

ROLE OF IMAGING

A computed tomography (CT) scan is the finest initial radiographic imaging evaluation. The presence of gas in soft tissues, which is most commonly seen in the setting of clostridial infection or polymicrobial (type I) necrotizing fasciitis, is the most useful finding. This finding is highly specific for NSTI and should require early surgical intervention. Fluid collections, the absence or variability of tissue enhancement with intravenous contrast, and inflammatory alterations underneath the fascia are all possible radiography findings. For detecting gas in soft tissues, magnetic resonance imaging (MRI) is less effective than computed tomography (CT). Furthermore, MRI is extremely sensitive, overestimating deep tissue involvement and hence unable to effectively discriminate between necrotizing cellulitis and deeper infection.[6] Ultrasound can detect isolated abscesses and gas in tissues, although it hasn't been thoroughly researched in necrotizing fasciitis.

MEDICAL MANAGEMENT

Adults

- 4 g + 500 mg piperacillin-tazobactam (IV) every 6 hours and
- Clindamycin (IV) 900 mg every 8 hours 2,3,4.
- Ceftriaxone (IV): 2 g once a day and Metronidazole (IV): 500 mg every 8 hours can also be used if Streptococcus Pyogenes has been ruled out.

If MRSA is detected, each of the above-mentioned methods should be supplemented with Vancomycin (IV) 15-20 mg/kg every 12 hours.

Children

1. Piperacillin-Tazobactam (IV): 100 mg/kg piperacillin component per dosage, given every 8 hours.
2. Clindamycin (IV)

- Neonates: 5 mg/kg each dose, administered every 8 hours;
- Children's dose: 10 mg/kg, administered every 8 hours.

If Streptococcus pyogenes has been ruled out Ceftriaxone (IV): 80 mg/kg per dose, once a day and metronidazole (IV) can also be used:

- ***Neonates:*** 7.5 mg/kg per dose, administered every 12 hours
- ***Children:*** 7.5 mg/kg per dose, administered every 8 hours

If MRSA is suspected Vancomycin (IV) should be added to both of the above-mentioned options as follows

- ***Neonates:*** 15 mg/kg per dose, given every 12

hours

- ***Children:*** 15 mg/kg per dose, given every 8 hours.

Intravenous immunoglobulin can be considered in cases of severe necrotizing fasciitis, although efficacy has not been proven.

SURGICAL MANAGEMENT

Primary treatment of necrotizing fasciitis is early aggressive surgical exploration and debridement of necrotic dead tissue with recommended antibiotics coverage is mentioned in all guidelines.

Surgery: Extensive Wound Debridement (Fig. 1) is associated with appropriate broad-spectrum intravenous antibiotic therapy. During wound debridement, extensive debridement of dead tissues that cross beyond the area of involved tissues are needed. The wound should be left open post debridement and the wound re-inspected 24 hours later to assess the adequacy of the initial wound debridement. Antibiotic therapy is depends on gram stain and culture tests. If group A streptococcus is confirmed to be the cause, high dose penicillin or ampicillin and clindamycin, which blocks toxin production must be given.[4]

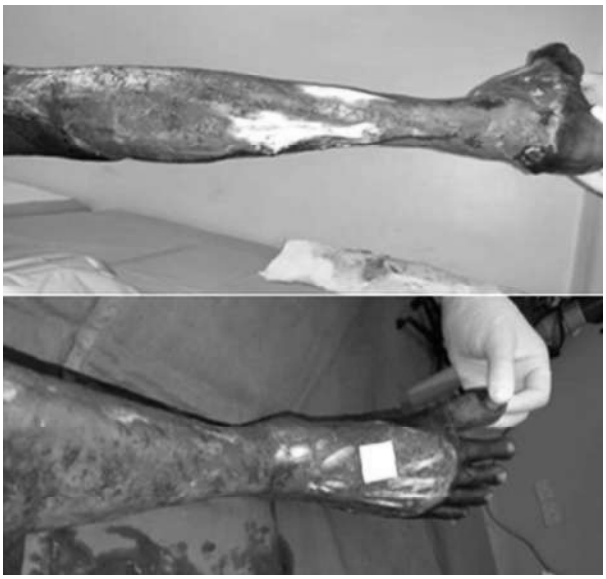

Fig. 1: Post debridement of the excision of the necrotic tissues should extend until healthy tissue is found, but should be limited to the edges of the infection

VAC therapy (Fig. 2) can be used for the superchargerd granulation of the wound after initial wound debridement to remove the exudates and necrotic sloughs from the wound.

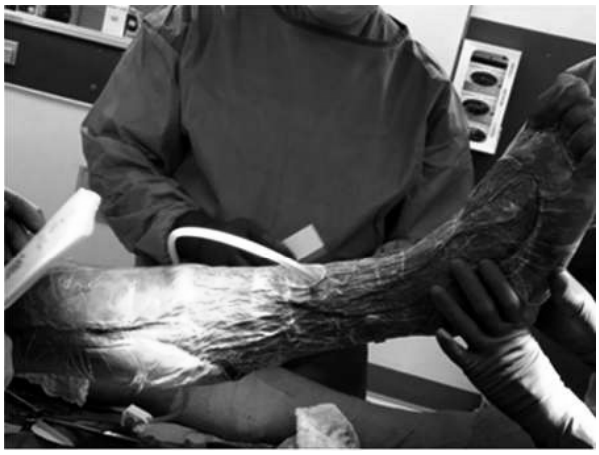

Fig. 2: Vaccum Therapy in Necrotising Fascitis.

WOUND COVER

Skin grafts were the most commonly used wound cover surgery commonly used all over the world with easier postoperative care (Fig. 3, 4, 5). Loco-regional flaps like Reverse Sural artery flaps in lower extremities were also used. Free flaps especially muscle flaps plays a important role in post necrotising fasciitis reconstruction with wound having exposed tendons and bones.

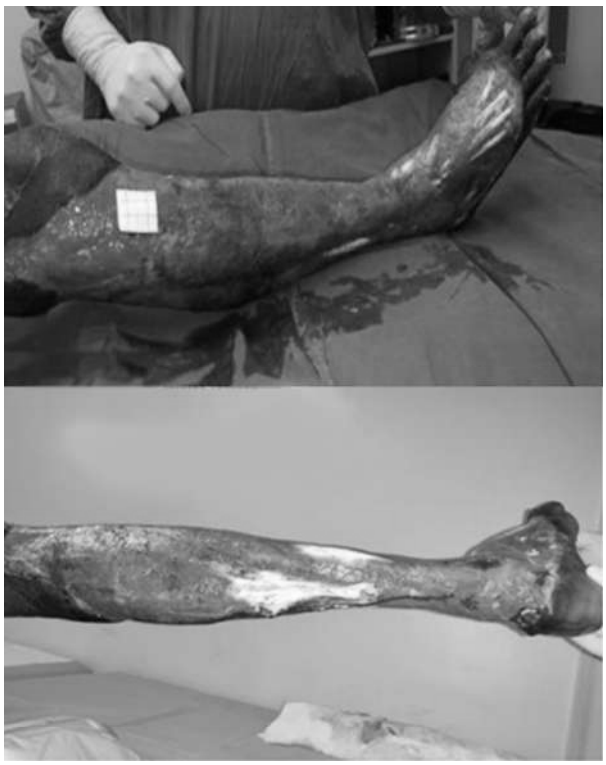

Fig. 3: Post Debridement of Necrotising Fascitis

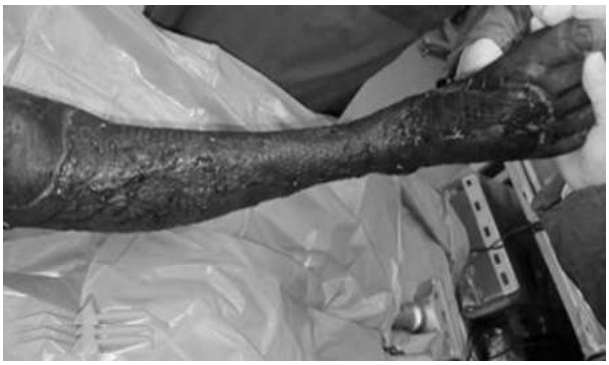

Fig. 4: Post Skin Grafting Day 10

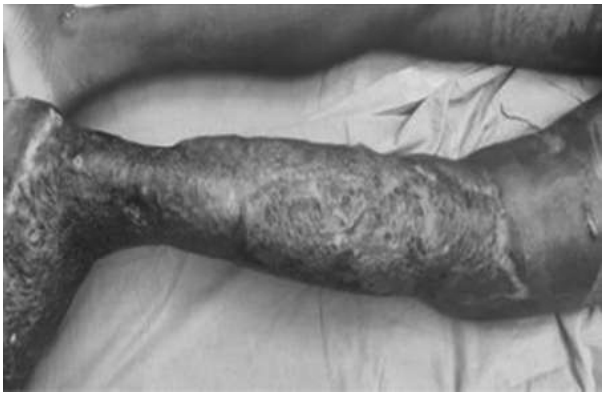

Fig. 5: Post Skin Grafting Day 30

Necrotizing fasciitis of the posterior neck raw area are covered using a Bilobedfasciocutaneous flap for repair following wound debridement. The blood supply of the bilobedfasciocutaneous flap originates from a row of musculocutaneous perforators of posterior intercostal arteries.[5]

The V-Y islanded fasciocutaneous flap, used to cover the urogenital region after necrotizing fasciitis wound debridement, is considered a option. The V-Y axial-pattern design of the flap is also considered a new option, which enabled the flap to be advanced and fashioned in the midline. The idea of using the V-Y-plasty design is popularised because the perineum has a pair of symmetrical anatomic structures. This procedure preserves tissue and the flap donor site is closed primarily without tension. Both aesthetic and functional results were satisfactory.[6] Free flaps like anterolateral thigh flaps, Lattismusdorsi flaps can be used for defects post debridement.[7]

Scrotal skin loss can occur following trauma, Fournier's gangrene, post tumour excision, burns for which there are techniques including residual scrotal skin mobilization, skin grafts, pedicle and free flaps. The management is complex due to the multiplicity of flaps and techniques. The Modified pudendal thigh flap used to reconstruct scrotal defects. This pedicle flap is reliable and produces a neo-scrotum that will be natural in appearance, good quality skin cover and cushion to the testes as well as protective sensation.[8]

CONCLUSION

Necrotizing fasciitis is a rare but life threatening condition, with a high mortality rate (mortality 32.2%) that approaches 100% without interventions. Comorbid conditions associated with this pathology, such as diabetes mellitus, immunosuppression, chronic alcohol disease, chronic renal failure, and liver cirrhosis, which can aggrarvate the rapid spread of necrosis, and increase in the mortality rate. The diagnosis of NF is difficult and the differential diagnosis between NF and other necrotizing soft tissue infections is difficult. However, the clinician should do their maximum effort to secure the diagnosis of NF, as a delay in diagnosis can be fatal to the patient. The early clinical picture includes erythema, swelling, tenderness to palpation, and local warmth, once the infection develops, the infection site develops skin ischemia with blisters and bullae. The diagnosis of NF can be faster with the use of scoring systems, such as the LRINEC score or the FGSI score, especially in cases of Fournier's gangrene. The diagnosis is definitely established by doing explorative surgery at the infected site. Management of the infection begins with antibiotic treatment. In the majority of cases with NF (70–90%) the pathogens are two or more, suggesting the use of broad-spectrum antibiotics. The value of antibiotic treatment in NF is relatively low, and early and aggressive drainage and debridement is required. In NF of the extremities, the clinician should consider amputating the infected limb if there is aggressive involvement. Finally, postoperative management of the surgical wound is important, along with proper nutrition of the patient. The use of VAC therapy in wound management has greatly improved the results of postoperative management.

Conditions Included in the Differential Diagnosis Include4

- ***Cellulitis***: Cellulitis presents with skin erythema, edema, and warmth. Fever may be present, but cellulitis is generally not associated with hemodynamic instability or exquisite tenderness. Elevations in serum CK or AST concentrations suggest deep infection involving muscle or fascia (as opposed to cellulitis).

- ***Pyodermagangrenosum:***Pyodermagangrenosum may be challenging to distinguish from necrotizing fasciitis. The diagnosis is important because unnecessary surgical debridement of pyodermagangrenosum can cause extension of the lesion, and inappropriate usage of immunosuppressive therapy may worsen necrotizing fasciitis.
- ***Gas Gangrene (clostridialmyonecrosis):*** Gas gangrene (clostridialmyonecrosis) is an acute invasion of healthy tissue that occurs spontaneously or as a result of traumatic injury. Both gas gangrene and polymicrobial (type I) NSTI are diagnosed with gas in the tissues. In gas gangrene, the Gram stain usually demonstrates gram-positive rods, while, in polymicrobial necrotizing fasciitis, the Gram stain usually demonstrates mixed aerobes and anaerobes. The difference is important in that management of clostridialmyonecrosis may require amputation, whereas management of necrotizing fasciitis needs debridement (but limb salvage may be possible).
- ***Pyomyositis:*** Pyomyositis may be confused with necrotizing myositis. These conditions differ in that pyomyositis is defined by abscess formation in skeletal muscle, while necrotizing myositis is characterized by gangrenous necrosis. These are distinguished by clinical and radiographic features. Pyomyositis is caused by S. aureus and is usually associated with less systemic toxicity than necrotizing myositis.
- ***Deep venous thrombosis:*** Deep venous thrombosis (DVT) is characterized by extremity swelling, pain, and warmth; the pain is less extreme compared to the necrotizing infection. Fever may be present in DVT but is more common in the soft tissue infection.

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