# Management Strategy of Necrotizing Soft Tissue Infection in Immunocompromised Patients

## Thesis

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## GENERAL SURGERY

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# Abstract

**Purpose:** This study was designed to evaluate the outcome of delayed debridement in immunocompromised patients presenting with necrotizing soft tissue infection.

**Patients & Methods:** This study included the immunocompromised pediatric patients with cancer or on cancer treatment who present with necrotizing soft tissue infection in both Children Cancer Hospital and the pediatric oncology department of National Cancer Institute. After stabilization of the general condition of the patients and improvement of the local condition by developing line of demarcation between the necrotic area and inflamed area the patients underwent delayed debridement in the theatre with excision as less damaged dead tissue as possible.

**Results:** Our study included 20 patients, 13 males and 7 females with age ranging from 9 months to 16 years, the patients developed NSTI during cancer therapy. In 16 patients cannula site infection was postulated to be the triggering event of NSTI. After initial treatment with antibiotics. 5 out of 20 patients the antibiotics alone succeeded to halt the progress of infection and these patients required no admission in ICU as there were no signs of sepsis and the remaining 15 required ICU admission as the infection progressed to SIRS and 3 of them developed MODS that required mechanical ventilation and cardiac support by inotropes. 2 patients of the study group died. One of them after 1 year after debridement due to cause other than NSTI (after bone marrow transplantation) and the other died days after debridement. The remaining 18 patients showed improvement of the local wound condition with repeated dressing, only minimal bedside serial debridement was required after the first one and all of them underwent grafting of the bare area after development of the healthy granulation tissue with good functional outcome of the affected part with the aid of variable physiotherapy courses.

**Conclusion:** NSTI in immunocompromised patients with cancer is a pathology known of lethality. Delayed rather than early debridement was associated with negligible mortality rates and limb preservation with good functional outcome.

**Key words: Necrotizing Soft Tissue Infection, Immunocompromised, Debridement, Fasciitis, Systemic Inflammatory Response Syndrome, Multiple Organ Failure Syndrome.**

**بسم الله الرحمن الرحيم**

**اقْرأ وربك خلق الْإِنسانَ مِن علق۞ اقْرأ ِباسمِ ربك الذِي خلق۞**
**علم الْإِنسانَ ما لم يعلم۞ الذِي علم ِبالْقَلَمِ۞ الْأَكْرم۞**

صدق الله العظيم

(سورة العلق الآية ١-٥)

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| ALT | : Alanine Aminotransferase |
| aPTT | : Activated Partial Thromboblastin Time |
| ALL | : Acute Lymphoblastic Leukemia |
| AML | : Acute Myeloid Leukemia |
| ARDS | : Acute Respiratory Distress Syndrome |
| BUN | : Blood Urea Nitrogen |
| CNS | : Central Nervous System |
| CRP | : C Reactive Protein |
| CT | : Computed Tomography |
| DIC | : Disseminated Intravascular Coagulation |
| HL | : Hodjkin's Lymphoma |
| HLH | : Haemophagocytic Lymphohistiocytosis |
| HBO | : Hyperbaric Oxygen |
| HIV | : Human Immunodeficiency Virus |
| IFN-γ | : Intefreon gamma |
| ICU | : Intensive Care Unit |
| IV | : Intravenous |
| IVIG | : Intravenous Immunoglobulin |
| IL | : Interleukin |
| MODS | : Multiple Organ Dysfunction Syndrome |
| MRI | : Magnetic Resonance Imaging |
| NB | : Neuroblastoma |
| NHL | : Non Hodjkin's Lymphoma |
| NO | : Nitric Oxide |

NF : Necrotizing Fasciitis

MRSA : Methicillin Resistant Staphylococcus Aureus

NSTI : Necrotizing Soft Tissue Infection

PEEP : Positive End Expiratory Pressure

PMNs : Polymorphonuclear Leukocytes

PT : Prothrombin Time

SC : Subcutaneous

SIRS : Systemic Inflammatory Response Syndrome

TNF : Tumor Necrosis Factor

TT : Thrombin Time

UTI : Urinary Tract Infection

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# ***Introduction***

Standard management of the NSTI includes combination of antimicrobial chemotherapy, supportive care in an intensive care setting and surgical debridement.

Debridement is often performed in the early course of the disease in an attempt to decrease the septic load on the patient and hence improve the general condition of the patient.

The combination of these efforts; applying these strategies resulted in success rate of only 25%. Treatment outcome of NSTI in immunocompromised patients using these strategies reveals even worse outcome.

NSTI in immunocompromised patients might need revision of the strategy of early debridement. The infection is always extensive and spreads along a large area of the patient body owing to exceptionally weak immune system of the patient.

Debridement of the dead tissue in the early course of the disease probably removes only small percentage of the septic load with a drawback of opening and leaving large raw area in an already immunocompromised patient liable to invasion by microorganisms from the surrounding environment.

# ***Aim of Work***

- To evaluate the role of intermediate and delayed debridement in the management of NSTI in immunocompromised patients and their effects on the local outcome and mortality rates.

- Review of literature for different strategies of management of NSTI and their outcomes.

# Introduction

Necrotizing soft-tissue infection (NSTI) was first described by Hippocrates circa 500 BC, when he wrote, “Many were attacked by the erysipelas all over the body when the exciting cause was a trivial accident... flesh, sinews, and bones fell away in large quantities... there were many deaths” **(Descamps, 1994)**.

Despite many advances in our understanding of this disease and great improvements in medical care, the mortality associated with NSTI has not changed in the last 30 years and remains 25% to 35%.

Prevalence of this disease is such that the average practitioner will see only one or two cases in his or her career. Physicians cannot be sufficiently familiar with NSTI to proceed rapidly with accurate diagnosis and the necessary management.

NSTI was described as “hospital gangrene” by British Naval surgeons in the 18th and 19th century. Dr Joseph Jones, a Confederate Army surgeon, was the first person to describe this disorder in a large group of patients in 1871, when he reported on 2,642 cases and found a mortality rate of 46 % **(Jones, 1871)**.

In 1883, the French physician, Jean Alfred Fournier, described a similar NSTI of the perineum in five male patients a process that continues to bear his name. It is now described in both male and female patients.

In the ensuing years, many other terms, such as necrotizing erysipelas, streptococcal gangrene, and suppurative fasciitis, have been also been used. Because the gas-forming organism, Clostridium perfringens, can be associated with this infection, it has also been referred to as "Clostridial gangrene" or "gas gangrene".

In 1951, Dr. Wilson proposed the term necrotizing fasciitis to include both gas-forming and non gas forming necrotizing infection and stated that fascial necrosis is the sine qua non of this process **(Wilson, 1952)**.

More recently, the term necrotizing soft tissue infection has been advocated to encompass all forms of the disease processes, this is because necrotizing infection of all soft tissue involves a similar approach to diagnosis and treatment regardless anatomic location or depth of infection **(Fig. 1)**.

This single all-encompassing name facilitates understanding and assurance of proper management.

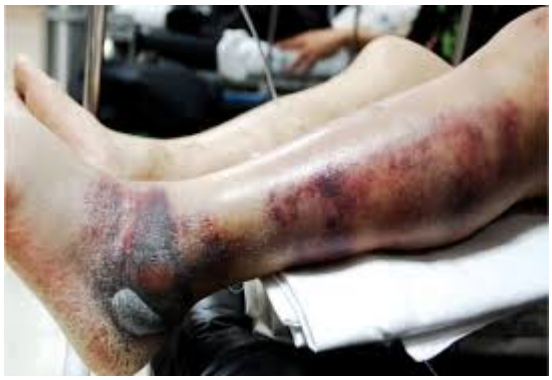

**Fig. (1)**: NSTI affecting the left leg and foot.

## *INCIDENCE AND CLASSIFICATION:*

NSTI has an incidence of approximately 1,000 cases per year in the United States or 0.04 cases per 1,000 people **(Ellis Simonsen, 2006)**.

The incidence of NSTI increased between 1980 and 2000, although the exact reason for this remains speculative. Possible explanations include increased microbial virulence and resistance because of excessive use of antibiotics, better disease reporting, or both. Regardless, although it remains rare, NSTI is a highly lethal condition requiring early aggressive intervention for salvage.

NSTI can be classified based on anatomy, depth of infection, or microbial source of infection.

Although these classification systems are not clinically useful because they do not affect diagnosis or treatment, they are useful in providing a common language for research.

## *RISK FACTORS AND CLASSIFICATION:*

Two basic microbial subtypes of NSTI are described **(Piedra, 2007)**:
Type I infections are the most common form of disease and are polymicrobial in nature.
Type II infections are monomicrobial and tend to occur in the perineal and trunk areas and are often diagnosed in immunocompromised patients, particularly diabetics and patients with peripheral vascular disease **(Freischlag, 1985)**.

Other risk factors for this type of NSTI include obesity, chronic renal failure, HIV, alcohol abuse, abscess, IV drug use, blunt or penetrating trauma, insect bites, surgical incisions, indwelling catheters, chicken pox, vesicles, and (rarely) perforation of the gastrointestinal tract (eg, carcinoma or diverticulitis).

Despite the plethora of risk factors, there is no specific inciting event identified for 20% to 50% of patients **(Childers, 2002)**.

In addition, the relative importance of each risk factor is unknown because studies evaluating this demonstrate wide variance between study populations and design.

Type I NSTI is far less common than type II infection and tends to occur in otherwise healthy, young, immunocompetent hosts. This infection is classically located on the extremities, although truncal involvement is well-reported.

Type II NSTI is a monomicrobial infection caused by group A Streptococcus (Streptococcus pyogenes) either alone or in association with Staphylococcus aureus.

Frequently, there is a history of recent trauma to or operation on the area. IV drug abusers are at risk for either type I or type II NSTI **(Chen, 2001)**.