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Necrotising Fascitis - A Prospective and Observational Study in S.C.B. Medical College and Hospital, Cuttack, Odisha.

1.Dr. Manabhanjan Bhimasingh Kanhar, 2.Dr. Abinasha Mohapatra, 3.Dr. Kumuda Bandhu Sahoo , 4.*Dr. Sudarsan Sethy

[1]Assistant Professor, Department of General Surgery, S.C.B. Medical College, Cuttack, Odisha, India, 768017

[2]Assistant Professor, Department of General Surgery, VIMSAR, Burla, Sambalpur, Odisha, India, 768017

[3]Assistant Professor, Department of Orthopedics, VIMSAR, Burla, Sambalpur, Odisha, India, 768017

[4]Assistant Professor Department of General Surgery, VIMSAR, Burla, Sambalpur, Odisha, India, 768017

CORRESPONDING AUTHOR'S NAME : Dr. Sudarsan Sethy

Abstract

Background : NSTI is an uncommon but life- threatening disease with a high mortality rate, ranging from 6 to 76% despite advances in modern medical care **.** Delays in diagnosis and debridement associated with increased mortality **.** Lack of specific clinical features and characteristics in the initial stages of the disease may be the main reason for the failure of early diagnosis **.** Anaerobic environment and vascular thrombosis in the affected area accelerate bacteria proliferation and through haematogenous spread, a distant infection may occur **. Materials and Methods :** This descriptive and observational type of study was conducted at SCB Medical College and Hospital, Cuttack from the period of Sep 2021 to Oct 2022 and included 55 patients of clinically diagnosed necrotizing soft tissue infection presenting to the surgical OPD and emergency. The clinical characteristics and laboratory findings were analyzed with the purpose of identifying key features that help in reorganization of this disease. Laboratory risk indicator for NSTI (LRINEC) score was calculated for all the patients. **Discussion and Results :** Male preponderance was seen in patients of NSTI. Maximum number of patients were between the age of 41- 70 years. Majority of patients with NSTI were found to be afebrile (%), having normal blood pressure(69.09%) but having tachypneoa (56%). Local tenderness,swelling, skin discolouration was the most commonly noted examination finding of NSTI (87.3%), followed by edema of overlying skin (87%), warmth (64%) and exudative discharge (81.8%). Streptococcus pyogens (34%) and staphylococcus aureus (27%) were found to be the most common microbe's infections causing NSTI. High CRP was found in 65% patients of NSTl. Hyperglycemia is frequently encountered in NSTI. The LRINEC scoring for all the patients was done and it was observed that a higher score is more predictive of NSTI whereas a lower score (<5) does not rule out the possibility of NSTI (27 out of 55 patients had a score <5). A higher score should mandate more aggressive resuscitation, monitoring and surgical intervention. **Conclusuon** : Because of the potential fatal course of NSTI, prompt diagnosis is the key to

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a favorable outcome. Laboratory1 findings and other diagnostic tests may be useful adjuncts, but the diagnosis is still primarily a clinical one. and suspicion alone warrants early surgical intervention.

Key Word - Necrotizing soft-tissue infections, LRINEC scoring system, Alanine Transaminase, Aspartate Transaminase, Alkaline Phosphatase,

Introduction

Necrotizing soft-tissue infections (NSTIs) can be defined as infections of deep subcutaneous tissue, superficial fascia, deep fascia, or muscle or any combination of the three and associated with necrotizing changes. NSTIs is charterised by sudden presentation and rapid progression. It is typically polymicrobial in nature They are usually caused by the synergistic presence of various aerobic or anaerobic, gas producing or not, bacteria. Their progression is often fulminant and it has been recognized for centuries. NSTI may appear in any anatomical region, multiple layers may be involved at times and, despite the portal of entry being a rupture in the skin continuity, sometimes this cannot be found **[1].**

The lower limbs, perineum and abdomen are the most common sites of NSTI infections. It may develop after any kind of operations like incarcerated inguinal hernias, perianal abscesses, urological operations and gynaecological operations **[2,3] .** Also NSTI has been reported after blunt or penetrating injury, postoperative complications, injection of intravenous drugs or subcutaneous insulin, animal bites and idiopathic causes **[4,5] .** A portal of entry as obvious as a tissue injury is required for the development of a NSTI. However, these infections may occur without such portal of entry. **[6]** After colonization the bacteria produces toxic proteolytic enzymes which allow for tissue invasion **[7] .**

Predisposing factors of NSTI include advanced age, diabetes mellitus, malnutrition, intravenous drug abuse, corticosteroid use, immunosuppression, AIDS and chronic venous or lymph insufficiency with tissue oedema **[8,9] .** The presence of a foreign body with dead soft tissue and extensive abdominal or perineal operations, as well as tissue ischemia most often due to tight sutures, haematomas, peripheral angiopathy, or irradiation and wide burns, are considered to be local predisposing factors **[10,11] .**

The purpose of this study was to develop a detailed clinical profile of necrotising soft tissue infections as an aid to diagnosis and for proper management.

AIMS AND OBJECTIVES:

- To study the Clinical profile of necrotizing soft tissue infections.

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- To critically assess bulky waste operations by local authorities, including volumes/types of materials arising and current disposal/recovery routes.
- To classify and evaluate the operation of furniture recovery schemes nationally.
- To make recommendations to improve the operational effectiveness of, and to maximise recovery opportunities of bulky waste collection.

MATERIALS AND METHODS

The present study was conducted in the Department of General Surgery at SCB Medical and Hospital Cuttack over a period from Sep 2021 to Oct 2022. Written and informed consent was taken from all the patients who participated in this study.

Study Design:

The present study is prospective and observational type of study. The total cases included in this study were 55.

Inclusion Criteria:

All patients who presented with infections of any of the layers of the soft tissue compartment - dermis, subcutaneous tissue, superficial fascia, deep fascia, or muscle, that were associated with necrotizing changes and diagnosis confirmed by tissue biopsy.

Exclusion Criteria :

- Patients who refused to participate
- On investigation found not to be having NSTI

Study Tools:

Study tools used for this study included:

1. Clinical observation, sign and symptoms were documented
2. Relevant blood investigations, Biopsy for histopathological confirmation at the time of wound exploration and debridement, and tissue samples for bacteriological cultures and antibiotic sensitivity were sent.

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3. LRINEC scoring system was used **[12] .**

Data Management & Statistical analysis:

Descriptive statistics were expressed as means and standard deviations.

OBSERVATION AND RESULTS

.

Table 1 : Distribution of patients presenting with NSTI based on their age group

Age in Years	No. of Patients (n=55)	Percentage (%)
< 10	00	00
11 - 20	00	00
21 - 30	05	9.1
31 - 40	12	21.8
41 - 50	12	21.8
51 - 60	13	23.6
61 - 70	08	14.5
➢ 70	05	9.1

Mean age of the study population was 52±13.98 years. The youngest patient was 25 years of age, with the oldest being 85 years. Majority of the patients were seen to be between 31 to 60 years of age.

Maximum number of patients in the study group belonged to the age group of 51 to 60 years (23.6%), and 31 to 40 years(21.8%), 41 to 50 years (21.8%). Most of the study population was between the ages of 31 to 60 years (67.2%). Only 5 (9.1%) patient was aged more than 70 years. Almost nil prevalence of NSTI was seen in the younger age group with patients less than 10 years of age and between 10 to 20 years of age and 5 (9.1%) belonging to the age group between 20 to 30 years.

Table 2 : Patient's pulse range

Pulse range (beats per minute)	No. of Patients (n=55)	Percentage (%)
71 - 80	29	52.7
81 - 90	26	47.3
91 - 100	00	00
101 - 110	00	00
111 - 120	00	00
121 - 130	00	00

Maximum number of patients 52.7 % (29) people have pulse ranging from 71 to 80. Tachycardia (pulse > 100 beats/min) was seen almost nil. Tachycardia was reported in overall 47.3% of patients of NSTI, while a majority (52.7%) had a normal pulse. Mean value came out to be 80.73 beats/min

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Table 3 : Distribution of patients based on increased temperature

Temperature	No. of Patients (n=55)	Percentage (%)
Female	24	44
Male	31	56

Only 24(44%) of patients of NSTI were found to be febrile. 31(56%) of patients of NSTI did not show any rise in temperature. The mean temperature of the patients comes out to be 37.4° C.

Table 4 : Distribution of patients based on respiratory rate

Respiratory rate (cycles/min)	No. of Patients (n=55)	Percentage (%)
< 15	24	44
16 - 30	31	56
➢ 30	00	00

In the present study, out of 55 patients, there were 24(44%) with decreased respiratory rate and none with increased respiratory rate.

Table 5: Distribution of patients based on local examination

Clinical Presentation	No. of Patients (n=55)	Percentage (%)
Skin discolouration	48	87.3
Swelling	48	87.3
Warmth	46	83.6
Tenderness	48	87.3
Edema of overlying skin	48	87.3
Crepitus	08	14.5
Dermal gangrene/necrosis	25	45.5
Ulceration	24	43.6
Exudate	45	81.8
Foul odour	20	36.4
Bleeding	00	00

Skin discolouration, swelling tenderness and edema of overlying skinwas the most commonly reported clinical presentation of NSTI, with 48 (87.3%) of patients having Skin discolouration, swelling, tenderness and edema of overlying skin of the involved region. Other commonly reported manifestations included, Warmth(83.6%), Exudate (81.8%),Ulceration (43.6%),Foul Odour (36.4%),Crepitus(14.5%) and Bleeding was not found in any of above clinical presentation of NSTI in our study population.

Table 6 : Percentage distribution of organism in culture and Sensitivity

Organisms in Culture	No. of Patients (n=55)	Percentage (%)

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Streptococcus Pyogenes	10	18
Staphylococcus Aureus	09	16
Escherichia Coli	05	09
Clostridium	14	25
Pseudomonas	04	07
Enterobacteriaceae	03	05
Klebsiella	08	15
Sterile	02	04

In the present study,we found that out of 55 patients, there were 47(85.4%) with mono microbial and 8(14.5%) with polymicrobial infection

Table 7 : Distribution of patients based on the site of NSTI

Site of NSTI	No. of Patients (n=55)	Percentage (%)
Neck	00	00
Right Breast	00	00
Left Breast	00	00
Right upper limb	04	7.2
Left upper limb	01	1.8
Abdomen	01	1.8
Scrotum	18	32.7
Labia	00	00
Right Gluteal region	02	3.6
Left Gluteal region	01	1.8
Right Thigh	04	7.2
Left Thigh	02	3.6
Right Leg	06	10.9
Left Leg	03	5.4
Right Toes	01	1.8
Left Toes	02	3.6
Right Foot	05	9.09
Left Foot	05	9.09

Most commonly lower limbs (56%) were affected in patients of NSTI, with predominantly right side being affected. 18 (%) patients had involvement of right foot is more as compared to only 13 (%) patient having NSTI involving the left foot. Similarly, 6(%) patients had NSTI involving the right leg. as compared to only 3 (%) patients with disease of the left leg. Scrotum was seen as the primary site of involvement in only 18 (%) of patients in this study. Labia, neck, breast, are found to be not involved, abdomen, arms, gluteal region and the thighs, were some other common sites of involvement of NSTI.

Table 8 : Percentage distribution of patients based on LRINEC score

LRINEC Score	No. of Patients (n=55)	Percentage (%)

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<= 5	27	49
6-7	11	20
>= 8	17	31

In this study there are 27(49 %) of cases having the LRINEC score <=5, while 11(20 %)of cases have score of 6-7, only17(31 %)have score of 8 or above, suggesting that 49 % of cases are expected to have <50 % expectancy of having NSTI, while 20 % cases are expected to have NSTI to about 50-75 % and 31 % cases have chance of having NSTI by 75 % and above having mean value of 6.6 ± 2.5.

Discussion

In this study the maximum number of affected individuals are males (87%).The male preponderance amongst patients of NSTI is also noted in other reports, such as the study done by Yi-Chun Su et al **[1] .**

in which a tola! of 209 patients were enrolled and analyzed out of which 146 were male (69.9%) and 63 were female (30.1%). Similar finding can be seen in the study David C. Elliott ct al **[13]** , FP Sin et al **[14] ,** Daniel A. Anaya et al **[15,16].**

AGE

The present study was conducted on subjects with a mean age of 52+_13.98 years. This data was comparable to the study conducted by Yi-chun Su et al (68) in which a total of 209 patients were enrolled and the mean age came out to be 56.8 + 15.7 years. David Wilkinson et al **[17]** in their study on NSTI showed a mean age of 48 years. Similar age group of NSTI patients was reported by Daniel A Anaya et al **[15,16] .**

From this data it is seen that NSTI afflicts the middle aged individuals to a greater extent than either extreme of age. This may be due to the increased environmental exposure outside the home in adult patients.

HEART RATE

Majority of patients in this study 52.7% had a normal pulse on examination with tachycardia noted in 47.3% of patients only. Mean value camc out to be 92.3 beats/min. This finding is different from previously published studies, in that, most of the patients in those series had a higher pulse rate. As most of patients in this study had normal pulse rate, tachycardia alone may not be a reliable sign to diagnose presence of NSTI. Increase in the pulse rate is an indicator of systemic inflammatory response syndrome. Studies by David C. Elliott et al **[18]** and Daniel A. Anava et al **[15] ,** also report tachycardia in NSTI patients with a mean pulse of 111 beats/min and 108 beats/min respectively

TEMPERATURE

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From this study it was noted that only 44% of patients of NSTI were febrile whereas 56% of patients of NSTI did not show any rise in temperature. In the present study mean body temperature of patients with NSTI was found to be 37.4°C. In a review of 89 patients by Wong et al **[12]** it was found that 53% were febrile at presentation and the mean value was 37.1°C. There are other studies in which the mean temperature of patients with NSTI is in the same range, as reported by David C. Elliott et al **[18] ,** Daniel A. Anaya et al **[19]** . However in this study the overall number of patients with fever was less as compared to other studies.

RESPIRATORY RATE

Only 44% of patients of NSTI had a normal respiratory rate of < 15 breaths per minute. 56% had tachypneoa in the study group with mean respiratory rate of the entire study population being 21 ±2.8 breaths/min. None of the previous studies mentioned have assessed tachypneoa as a feature of NSTI. And neither is respiratory rate a factor for scoring NSTI in the LRINEC system. In this respect this study highlights the importance of increased respiratory rate as a feature of NSTI.

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LOCAL FINDINGS

Tenderness ,swelling and skin discolouration are the most commonly elicited clinical sign of NSTI, with 87.3% of patients having tenderness,swelling and skin discolouration of the involved region. Other common local manifestations included, crepitus 14.5% .,Exudate 8.9%, edema of overlying skin (66%), swelling (64%), warmth (83.6%) and skin necrosis (45.5 %), Foul odour (36%),Bleeding from the involved region was not seen on clinical presentation in this study. Similar local clinical findings were reported by Kuo-Feng Huang et al **[20]** in patients with NSTI admitted to the hospital as follows: swelling (83.7%), pain (74.3%). erythema (61.0%), pus discharge (18.9%), skin discoloration or induration (16.1%), blistering (13.3%), foul odor (10.8%). bleeding (8.3%) and crepitus (4.9%). Various other studies showed similar prevalence of common local findings in NSTI. In the present study tenderness, swelling and skin discolouration was the most commonly observed clinical finding in 87.3% of patients, similarly David C Elliot et al **[13]** reported tenderness in 72% of patients, FP Sin el al **[21]** in 92% of patients and Krieg A Rohrborn et al in 81% of patients. We reported swelling in 87.3% of patients, whereas FP Sin et al **[20]** and Kricg A Rohrbom el al both reported swelling in 92% of patients. Similar to our study skin discolouration was reported in 83% of subjects by FP Sin et al **[22]** . In the present study a large number of patients (45.5%) were seen to have necrosis of skin and soft tissue, but other studies done by David C Elliot et al **[18]** , FP Sin et al **[21]** and KricgARohrbom et al reported a much lower prevalence of necrosis among NSTI patients of 31%, 25% and 27% respectively.

The finding of crepitus on examination in this study was noted in 14.5% patients only as compared to other studies by David C Elliot et al **[18]** and Brig Gurjit Singh et al **[20] ,** which report crepitus as a

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finding in approximately 36.5% and 23% of patients respectively. This may be explained on the basis of presence of gas producing organism like Clostridium and some other anaerobic organism as the cause of NSTI reported in these studies. These organisms are not commonly causative of NSTI in our study, which explains the variability of this finding. The findings similar to this study can also be seen in paper by Salvador et al In their study, only 14 had the medical records out of which there were 14% patients presenting with crepitus against 14.5% as seen in the present study. In the present study there were 87.3% patients with local edema,tenderness and swelling. Other similar studies by Brig Gurjit Singh et al **[23]** and Krieg A. Rohrbom et al, showed edema as a significant local finding.

INFECTIVE ORGANISMS

In this study the maximum number of patients were found to be infected by Clostridium 25%. Furthermore18% infected by Streptococcus pyogenes,16% were infected by staphylococcus aureus, 5 % by enterobacter, 15% by Klebsiella and . Polymicrobial infection was noted in only 14.5% of patients. These results are comparable to the other studies where), Anaya et al **[16]** and Krieg et al clostridial infection accounts for about 20% - 30% of NSTI. In this study prevalence (25%) of clostridial infection was reported. Skin based organisms are chiefly responsible for NSTI and together staphylococcal and streptococcal species accounts for 34% of all cases. Similar high prevalence of staphyloccal and streptococcal infection was reported by Elliott et al **[18] ,** Anaya et al **[24]** and Krieg et al, ranging from 57% to 80%. In the light of this observation it seems prudent to include gram positive antibiotic coverage in any treatment regime for NSTI. Culture results should guide further antibiotic therapy. In this study tissue culture was positive in all case but two. These results also suggest that there is no pressing requirement for anaerobic culture in patients of NSTI.

SITE OF INFECTIONS

In this study, we can see that there are 61.36% cases having the site of infection as lower or upper extremities suggesting there is more NSTI predisposition to the limbs than to any other part of the body. Similar finding was reported by Kuo-Feng Huang et . Daniel A. Anaya ct "al **[15,16] ,** FP Sin el al **[14]** and D.J. Tilkornct al also reported a high prevalence of NSTI involving the extremities ranging from 64.3% to 93%.

LRINEC Score

The mean value of LRINEC score is 6.6 + 2.5 in our study. Similar findings arc seen in the study by D. J. Tilkorn et al in which 25 out of 30 patients (83.3%) had a LRINEC scorc> 6. Only in 5 patients (16.7%), the LRINEC score was < 6, also it showed the LRINEC mean value of 7.3 against the values in our study showing 27(49%) in<6 score and 28 (51 %) patients. Similarly in a study done by Chin-Ho Wong et al **[12] ,** using the LRINEC score, he stratified the patients into three groups, low (LRINEC score <5), moderate (LRINEC scorc 6- 7). or high (LRINEC score >8) risk categories for NSTI. These risk groups corresponded to a probability of developing NSTI of <50%. 50-75%, and >75% respectively. 51% of

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patients with NSTI had a LRINEC score of >6 whereas only 49% had a score of <6, comparative to our study having 49% of patients having <6 scorc and 51% patients having score >6. The mean value of our study- was 6.6 + 2.5, comparable to Wong's value of 7.

This finding shows the LRINEC score is capable of detecting early- cases of NSTI among patients with severe soft tissue infections. A LRINEC scorc of >6 should raise the suspicion of NSTI, and a score of >8 is strongly predictive of this disease.

The LRINEC score can significantly decrease the time to diagnosis by stratifying patients into risk categories for NSTI warranting immediate further evaluation. Clinical variables alone are often nonspecific early in the course of the disease and can potentially lead to fatal delay in operative treatment. A diagnostic score that includes clinical as well as laboratory variables would inevitably favor advance cases of NSTI (where clinical recognition is usually not a problem) and risk missing early cases of NSTI (where early diagnosis would profoundly affect outcome). An objective diagnostic tool based on laboratory' variables alone to assess for the possibility of NSTI is therefore advocated.

Conclusion:

For the diagnosis of NSTI the local clinical findings viz tenderness, skin discoloration, swelling of paramount importance rather than clinical features of systemic toxicity such as fever and tachycardia. Simple laboratory evaluation using the LRINEC scoring system is useful for diagnosing NSTI. A higher score (>6) is highly predictive of presence of NSTI, but LRINEC score of (< 5) does not altogether rule out the possibility of NSTI. The microbiology of NSTI reveals majority of infections being monomicrobial and caused by skin based organisms (staphylococci and streptococci). Therefore tissue culture and gram positive coverage are vital for NSTI patients.

Conflict of Interest – NIL

Funding - NIL

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