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ORIGINAL RESEARCH

To study the clinical profile of Necrotizing soft tissue infections

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Abstract

Background: Necrotizing soft-tissue infections (NSTIs) are common in the Indian subcontinent and are associated with high morbidity and mortality. The aim of this study to determine the e clinical profile of Necrotizing soft tissue infections.

Material and methods: The study included 100 patients with necrotizing soft tissue infections characterised by rapid, extensive tissue necrosis. Patients who were diagnosed with pyaemic abscesses, cellulitis, impetigo, furuncles, carbuncles, or erysipelas were not allowed to take part. In this study, patients were randomly assigned to one of two Categories. The first Category (Category 1: survival) experiences no morbidity at all, but the second Category (Category 2: morbidity/mortality) does. Patients were followed up with in the outpatient setting for up to 4 months post-discharge for things like dressing changes, continued management of diabetes and hypertension, and monitoring of liver and kidney function. Major amputation patients were advised to start using crutches and an artificial prosthesis after 3 months. During this time, patients had physiotherapy for their stumps.

Results: There were 88% men and 12% females among the patients. 55% of patients were between the ages of 35-45, and the illness is spread symmetrically between the lower and upper end of this age range. The patients were 52.58±5.74 years old on average. Patients' average intervention delay is 11 days. 40 patients were classified as Category 1 and the remaining 60 as Category 2. When compared to Category 1, the mean value of HB was lower in Category 2 and the other bold parameters were higher in the same Category, but the difference was not statistically significant. However, a substantial rise in creatinine level was noticed in Category 2 patients compared to Category 1 patients. The average hospital stay in Amputation patients is excessively long, with substantial variability across patients and a minimum in death situations. Toe disarticulation patients took 7 days longer than non-morbid cases, while Large Ulcer cases took 16 days longer. In the wound culture, 80 patients were infected with microorganisms. In 20 of the instances, no bacteria were discovered. The most prevalent were E. coli, Klebsiella, and Staphylococcus aureus. Other creatures, such as fungi, were not isolated. Meropenem and imipenem are among the most sensitive medicines, with sensitivity levels above 91% for the majority of bacteria. Colistin, tigeycycline, amikacin, gentamycin, piperacillin tazobactum, linezolid, and cefoperzone sulbactum are the other medications that were shown to be sensitive in around 52% of the instances in the current research.

Conclusion: Necrotizing soft tissue infections are a surgical emergency. Having a strong clinical suspicion of such infection in its early phases and initiating early and robust surgical therapy are critical components of successful care. When intravenous antibiotics fail to control an NSTI infection within 24 hours, quick, aggressive therapy is required for a positive outcome.

Keywords: Blood parameters, Mortality, Microbial culture

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Introduction

When it comes to treating patients, necrotizing soft tissue infections (NSTIs) consistently rank high on the list of challenging conditions. Although NSTIs may appear anywhere on the body, they often manifest themselves in the fatty tissue, fascia, or muscle under the skin's surface. Commonly caused by bacteria that produce toxins, NSTIs are characterised by rapid disease progression and severe tissue loss at the site of infection. [1]

Toxin production and bacterial strain have a role in determining whether symptoms of systemic poisoning manifest quickly or slowly. Once symptoms appear, the clock starts ticking on the patient's health, making prompt diagnosis and treatment of vital importance. Because the disease progresses under the skin, it is hard to diagnose, and the superficial symptoms mask a more serious underlying problem.[2] Clinicians should have an elevated index of suspicion for the presence of NSTIs because patients may experience pain and signs of systemic toxicity out of proportion to the findings of a skin examination as the infection develops. Conventional therapies include broad-spectrum antibiotics, intensive surgical debridement, and supportive care. Most patients need many surgical debridements, and survivors often have large, complex wounds that require extensive dressings and protracted stays in the hospital. Recent studies show that NSTIs have significant morbidity and mortality rates of 25% to 35%, even with proper treatment. [3]

The FDA has categorises skin and soft tissue infections into two different classes based on microbiological characteristics.[3,4] Approximately 80% or more of all NSTIs are type I infections like Fournier's gangrene and Ludwig's angina. [5] The vast majority of these conditions are caused by several microorganisms (caused by both aerobes and anaerobes). Type II infections, which account for 10–15% of all NSTIs, are often monomicrobial (caused by Streptococcus or S. aureus) and manifest themselves after a small injury. [6,7] Age, diabetes, peripheral vascular disease, obesity, chronic renal failure, HIV, alcohol abuse, IV drug use, abscess, severe or penetrating trauma, insect bite, surgical incision, and postponing surgical debridement are all risk factors for NSTI death. Since there aren't enough people in most NSTI series to reliably identify risk factors for mortality, we can't say for sure what causes NSTI deaths. [8] The aim of this study to determine the e clinical profile of Necrotizing soft tissue infections.

Material and methods

Our study was a prospective observational study performed. The study included 100 patients with necrotizing soft tissue infections characterized by rapid, extensive tissue necrosis. Patients who were diagnosed with pyaemic abscesses, cellulitis, impetigo, furuncles, carbuncles, or erysipelas were not allowed to take part. Name, age, occupation, socioeconomic position, address, onset of symptoms, risk factors, and co morbidities were only few of the categories covered by the proforma case sheet. Documentation of the complaints and supporting data was given in reverse chronological order. When they checked in, the lab tests started right away. Routine laboratory testing should include a complete blood count (haemoglobin, white blood cell, and platelet [PLT] count), fasting and postprandial blood sugar (FBS, PPBS) and corresponding urine sugar, urinalysis for albumin, sugars, ketones, and microscopy, blood urea and serum creatinine, serum electrolytes, lipid profile, radiograph of affected part (lower limbs), wound discharge for culture and sensitivity, arterial. All patients underwent the same routine. After a careful assessment of the patient's condition, resuscitation was begun and maintained until a stable heart rate was achieved. Each patient's level of infection was assessed, and then they had prompt, thorough surgical debridement of all necrotic tissue. Amputees had fingers or limbs removed if needed. The patient was given intensive treatment, which includes mechanical ventilation, invasive monitoring, and inotropic support, as shown by their condition. At first, cephalosporin and

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metronidazole were given to everyone, but then it was realised that aminoglycosides were necessary, so they were given to everyone as well, with some adjustments made for culture and sensitivity. Blood samples, surface swabs, and debrided tissue were all used to grow bacteria in a lab. All wounds were assessed for the need for further debridement within 24 hours after the first debridement.

The wounds were cleaned twice daily with a solution of hydrogen peroxide and povidone iodine. In order to protect the raw areas while they healed and began granulating, a skin transplant was used. The power of secondary intention may be a powerful healer. Wide-ranging amputations were necessary for certain individuals in order to stem the progression of the disease. In a few cases, defects have been restored via plastic surgery. Deaths and hospitalizations of all patients were recorded. Diabetic therapies, including nutrition, sugar restriction, and anti-diabetic drugs such oral hypoglycemic tablets and insulin, were used to manage individuals with diabetes. In the past, people with renal issues were treated by limiting their salt intake, starting dialysis, or receiving other forms of renal support treatment. Bed sores caused by NSTIs were treated with standard care, including the use of bandages and water/air mattresses. Patients with septicemia were cared for on ventilators in intensive care units by physicians and anesthesiologists. In this study, patients were randomly assigned to one of two Categories. The first Category (Category 1: survival) experiences no morbidity at all, but the second Category (Category 2: morbidity/mortality) does. Patients were followed up with in the outpatient setting for up to 4 months post-discharge for things like dressing changes, continued management of diabetes and hypertension, and monitoring of liver and kidney function. Major amputation patients were advised to start using crutches and an artificial prosthesis after 3 months. During this time, patients had physiotherapy for their stumps.

Examining the Data Statistically

Manifold categorization and hypothesis testing are used in the statistical analysis. Using two- and three-way tables, we examine the correlation between blood parameters, age, intervention delay, and associated co morbidities and their effects on mortality and morbidity. We used segmented bar graphs, pie charts, circles, and cones to graphically present the information. The significance of statistical parameters may be determined using normal tests, T tests, and the analysis of variance level of significance.

Results

Table 1 show demographic profile of the patients. The research included 100 participants with NSTI. They are all treated concurrently, according to a standard regimen. There were 88% men and 12% females among the patients. 55% of patients were between the ages of 35 - 45, and the illness is spread symmetrically between the lower and upper end of this age range. The patients were 52.58±5.74 years old on average. Patients' average intervention delay is 11 days. The lower limb is the most often implicated region, followed by the upper limb, and finally the perineum/genitalia, i.e. Fournier's gangrene. The most prevalent co morbidity associated with necrotizing soft tissue infections is diabetes mellitus, followed by hypertension and peripheral vascular disease.

Following analysis, 40 patients were classified as Category 1 and the remaining 60 as Category 2. When compared to Category 1, the mean value of HB was lower in Category 2 and the other bold parameters were higher in the same Category, but the difference was not statistically significant. However, a substantial rise in creatinine level was noticed in Category 2 patients compared to Category 1 patients, as shown in Table 2.

Table 3 shows the age-related outcomes of NSTI patients. Large ulcers were seen in 30 individuals in Category 2, with the majority of them being between the ages of 35 and 45. In

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Category 2, 11 patients died, and big ulcers were the major cause of morbidity in 6 of them. Amputation is common in those over the age of 55 in three out of every thirteen cases.

The average hospital stay in Amputation patients is excessively long, with substantial variability across patients and a minimum in death situations. Toe disarticulation patients took 7 days longer than non-morbid cases, while Large Ulcer cases took 16 days longer. The average hospital stay in patients who died is shorter as a result of two early fatalities caused by misdiagnosis of cellulitis rather than life-threatening necrotizing soft tissue infections and incorrect selection of narrow spectrum antibiotics rather than wide spectrum antibiotics.

Table 5 shows the pattern of organisms cultivated from wounds. In the wound culture, 80 patients were infected with microorganisms. In 20 of the instances, no bacteria were discovered. The most prevalent were E. coli, Klebsiella, and Staphylococcus aureus. Other creatures, such as fungi, were not isolated.

Out of 100 patients, 80 were afflicted with various germs. Antibiotic sensitivity was assessed on all 80 wound cultures. Meropenem and imipenem are among the most sensitive medicines, with sensitivity levels above 91% for the majority of bacteria. Colistin, tigeycycline, amikacin, gentamycin, piperacillin tazobactum, linezolid, and cefoperzone sulbactum are the other medications that were shown to be sensitive in around 52% of the instances in the current research. As shown in Table 6, the primary risk factor for NSTI in the current investigation was trauma in 36 patients, followed by bites in 31 patients, poorly treated pre-existing lesions in 18 instances, and idiopathic in 10 cases. Complications occurred in 30 individuals. Septicemia is the most prevalent complication of MODS. After intensive care unit therapy and higher generation antibiotics such as colistin and meropenem, three patients with MODS survived septicemia.

Table 1 Demographic profile

Age in years	**Number**	**%**
below 20	5	5
20-35	15	15
35-45	55	55
45-55	18	18
above 55	7	7
Gender		
Female	12	12
Male	88	88
Site of involved		
Lower limb	82	82
Upper limb	8	8
trunk	4	4
Fournier’s gangrene	6	6
Co morbidities		
Diabetes mellitus	41	41
Hypertension	20	20
Others (IHD, stroke)	39	39
Average intervention delay	11 days	

Table 2: Blood profile of the patients

Parameters	**Category 1**	**Category 2**	**P value**
HB	13.02±2.01	12.01±1.89	0.39
TC	16615.45±5511.48	20117.23±9878.29	0.21
ESR	65.21±27.54	74.69±32.36	0.33

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RBS	190.69±131.58	199.87±166.54	0.74
Creatinine	1.19±0.39	1.63±0.79	0.04

Table 3: Age wise outcome of NSTI patients

Age (in years)	Category 2					
	Large ulcer	Toe disarticulation	Amputation	Death	Nil (Category1)	Total
below 20	2	-	-	-	3	5
20-35	8	-	-	-	7	15
35-45	16	4	9	6	20	55
45-55	1	2	1	4	10	18
above 55	3	-	3	1	-	7
Total	**30**	**6**	**13**	**11**	**40**	100

Table 4: Hospital stays

Hospital stay	Mean±SD (days)
Amputation	42.25±13.69
Death	12.22±2.69
Large ulcer	33.45±19.36
Toe disarticulation	25.87±6.69
Nil (Category 1)	19.99±6.74

Table 5: Microbial culture

Growth	Number	%
Positive	80	80
negative	20	20

Table 6: Predisposing factors

Predisposing factors	Patients	Percentage
Trauma	36	36
Bites	31	31
Preexisting lesions	18	18
Idiopathic	10	10
Postsurgical/ intervention	5	5

Discussion

Non-specific bacterial infections (NSBIs), sometimes known as "flesh-eating illness," are very dangerous since they may result in death and permanent damage for patients. This condition affects a person's life in more ways than one. Although it is rare in developed countries, other illnesses like HIV, diabetes mellitus, and alcoholism create a perfect ground for this potentially fatal infection in countries like India. [9]

The bacterium Streptococcus is the most common cause of this disease. The incidence of NSTIs caused by Category A is much higher than that of Category B. M protein types 1, 3, 12, and 28 are produced by Streptococcus, as are the exotoxins A and B that these bacteria generate. Along with the exotoxins, the M protein acts as a super-antigen, causing the release of cytokines and the development of a toxic shock-like state. Staphylococcus aureus, Streptococcus pyogenes, and enterococci are all Gram-positive aerobes that have been linked

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to causing NSTI. Escherichia coli is the most prevalent Gram-negative bacterium in the intestines. Bacteroides species and Peptostreptococcus are the most common anaerobes. [9-11]
Infections that cause necrosis of the soft tissues may invade the deep fascia very rapidly. With no immediate medical attention, the prognosis is grim, and the mortality rate rises rapidly. Early diagnosis for emergency surgical debridement and broad-spectrum antibiotic treatment were the most effective interventions for NF mortality. [12] One hundred participants with NSTI were included in our study. The average age of the patients was 52.58±5.74 years. This closely matched the median age range of participants in the study by Park et al. [13] The analysis confirmed the gender imbalance found by Park et al. [10] In the vast majority of instances (82%), it was discovered that the lower limb was impacted. The results jived with those of other studies by Khamnuan et al. [9] Findings from this research were in line with those from Mishra et al. and Khamnuan et al., but at odds with those from Garg et al., who found no evidence of diabetes mellitus as a prominent co-morbidity in NSTI patients. In most cases, NSTI was associated with a respiratory disease. [1,12,14]
Increased mortality has been linked to shifts in a number of biochemical markers, including hematocrit, leukocyte count, blood urea nitrogen, creatinine, serum sodium, potassium, magnesium, calcium, serum albumin, lactate dehydrogenase, and alkaline phosphatase.[15-17]
Two or more abnormal values were found in the observed blood parameter at the time of admission in our series. The following parameters are assessed: serum creatinine, random blood sugar, glycated haemoglobin, white blood cell count, and erythrocyte sedimentation rate.
Multiple studies have shown that the most important factors influencing NSTI mortality are the timeliness and adequacy of the first surgical intervention.[18] There is a clear correlation between how long it takes to diagnose a problem and how long it takes to start treatment, making early diagnosis and action crucial. [18-21] As waiting times for interventions increased, so did patients' lengths of stay in hospitals. The present study found that the average time between intervention and the patient's mortality was 11 days, and that the average length of hospital stay for amputation patients was also excessively lengthy. Patients with toe disarticulation needed an extra 7 days, while those with large ulcers required an extra 16 days.
Thirty people had ulcers, six had toe disarticulation, thirteen had to have amputations, and eleven had died as a result of this inquiry. Rouse et al. found that 45% of deaths from NSTIs occurred within 10 days after the first debridement due to either persistent infection after inadequate debridement or rapid development of septicemia. [22] Within 11 days, 11% of patients in our research passed away because of severe sepsis. These results were quite similar to those discovered by Garg et al., who observed that 10 patients (17.2%) out of 58 ultimately passed away. [14] In a recent study including 35 people, Yanar et al. found a mortality rate of 40%. [23]
Various bacteriologic agents were detected in patients with NSTI in the present research. Eighty patients had bacteria cultured from their wounds. Twenty times out of twenty, no bacteria were found. Among the most common were Escherichia coli, Klebsiella, and Staphylococcus aureus. Fungi and other organisms were mixed in with the general population. This result backed with the findings of Kalaivani et al.[8]
The treatment's efficacy greatly increases when broad-spectrum antibiotics are given as soon as feasible when an infection is suspected. Within 24 hours of the start of the experiment, all individuals were given broad-spectrum antibiotics. 24 For the most part, the antibiotics meropenem and imipenem proved to be the most sensitive options, with sensitivity rates of 91% or higher. NSTI patients frequently have particular risk factors such as trauma, bites, preexisting lesions, or postsurgical infections.[25] Our study's results, which are in line with

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those of Kalaivani et al., indicate that trauma was the leading cause of NSTI acquisition for the vast majority of patients. [8]

Conclusion

Necrotizing soft tissue infections are a surgical emergency. Having a strong clinical suspicion of such infection in its early phases and initiating early and robust surgical therapy are critical components of successful care. When intravenous antibiotics fail to control an NSTI infection within 24 hours, quick, aggressive therapy is required for a positive outcome.

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