

# Necrotizing Soft Tissue Infections: Management and Outcomes in a Tertiary Care Hospital of North India

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## ABSTRACT

**Introduction:** Necrotizing soft tissue infections (NSTIs) are a group of fulminant infections which can involve any part of the soft tissue with high mortality rate. Hence, it requires prompt recognition and management consisting of critical care support and widespread surgical debridement.

**Methods:** The present study summarizes the epidemiology, clinical features, risk factors and treatment principles used to manage cases of NSTIs in a Tertiary care hospital of Delhi.

**Results:** NSTI was found to be more prevalent in males (72.06%), 66.17% of the cases were those who were already suffering from comorbidities. A high mortality rate of 20.59% was observed in the study.

**Conclusion:** Diagnosis is deciding factor for overall positive outcome in these cases, which is usually made on the basis of clinical history, physical findings and high index of suspicion.

Overall management needs a multidisciplinary approach.

**Keywords:** NSTIs, Necrotic, Debridement, Amputation, Mortality.

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## INTRODUCTION

Necrotizing soft tissue infections are characterized as a collection of rapidly advancing, often fatal infection of the soft tissue compartment (dermis, superficial subcutaneous tissue, superficial or deep fascia or muscles), associated with systemic toxicity and widespread necrosis and if not treated aggressively, results in high morbidity and mortality.

The incidence of NSTIs in USA is estimated to be around 500 - 1500 cases/year.<sup>1</sup> The mortality rates have been reported to be around 25% , although it is higher in some other studies.<sup>2</sup>

The basic principle of early diagnosis, prompt and broad antimicrobial therapy, and aggressive, serial surgical debridement remain the pillars of therapy, aimed at reducing mortality and morbidity.<sup>3,4,6</sup>

### Clinical Features and Diagnosis

The presentation of NSTIs varies widely, ranging from simple necrosis of skin and subcutaneous tissues to life threatening septic shock. The early signs and symptoms are identical to those seen in cases of abscess and cellulitis, thereby making the correct diagnosis very difficult. In general, the most common findings on physical examination are pain beyond the margin of obvious infection, swelling, erythema and fever. The cardinal sign suggestive of diagnosis of NSTI is pain that is disproportionate to physical findings.<sup>7-9</sup> Tachycardia (>100 beats/min) has been found in 59% cases and fever in 44% cases. Infective sites have

fluctuance (35%), induration (66%), tenderness (54%), erythema (80%) and skin necrosis (23%).<sup>10</sup>

The laboratory investigation commonly observed in NSTIs include leukocytosis, thrombocytopenia, hyponatremia, hypocalcemia, hypoproteinemia, elevated serum glucose levels, elevated creatinine levels and increased blood lactate. A laboratory risk indicator score was devised to predict the diagnosis of NSTIs. The six independent variables included in the scores were hemoglobin level, total leukocyte count, serum sodium, serum creatinine, serum CRP levels and glucose levels. The total score ranges from 0-13. The patients could be categorized into 3 groups based on the probability of NSTI namely low risk, intermediate risk and high risk patients.<sup>11</sup>

Imaging studies such as X rays and CT scan are of limited value in diagnosis of NSTIs. They are only helpful if there is gas in the tissue. However, suspicious clinical presentation with presence of gas in the tissue has been found to be pathognomonic of NSTIs. Early diagnosis of NSTI is difficult because early clinical features and manifestations may not be easily distinguishable from other simple skin infections. The first step towards diagnosis is to have a high index of suspicion.<sup>1</sup> So a proper clinical history and detailed physical examination are essential to establish an early suspicion of disease. All these cases that raise the suspicion of NSTIs should be immediately surgically explored for more definite

diagnosis and proper management. The diagnosis of NSTIs hence, should be made clinically and surgically.

Although NSTIs can occur in any part of the body, the most common site involved are extremities (36-55%), perineum (upto 36%) and trunk (18-64%).<sup>5,12-15</sup>

### Aetiology

The factors which have been found to be associated with increased risk of NSTIs are insect bites, illicit drug injections, adverse drug reactions, mild trauma, major traumas, surgical procedures and perirectal abscesses.<sup>13</sup> However, 30% of all NSTIs have been found to occur in previously healthy individuals who did not have any of the above factors. NSTIs can be classified on the basis of depth of involvement (fasciitis, necrotizing adipositis, myositis), anatomical part involved (fournier's gangrene, Ludwig's angina) or on the basis of microbial source of infection.

On the basis of microbial source of infection, it is divided into three broad categories. Type I infections – are mostly polymicrobial in nature and accounts for 80% of all cases of NSTIs, including Fournier's gangrene and Ludwig's angina.<sup>16</sup> The most common organisms involved are Bacteriodes, Streptococci, Staphylococci, Enterococci and family of Gram negative rods. Type II infections constitute 10-15% of NSTIs, usually occurs after a minor injury and are mostly monomicrobial in nature. Group A  $\beta$  hemolytic Streptococci and Staphylococcus aureus are the most common organisms in this group. Type III infections constitute only 5% of all NSTIs and are most commonly caused by Clostridium perfringens, that causes gas gangrene.<sup>17-19</sup> Various fungi such as Rhizopus, Mucor or Rhizomucor and other organisms like Aeromonas hydrophila and Vibrio vulnificus have also been found to cause NSTI in a few cases.<sup>20-22</sup>

### Management

The management of NSTIs requires aggressive resuscitation, broad spectrum i.v. antibiotics, complete surgical debridement and multidisciplinary supportive care. Complete debridement of necrotic and infective tissue has been found to be the most important determinant in the management of NSTIs. Early operative determinant is the most important factor on which the outcome depends.<sup>21,22</sup> Just for the sake of stabilizing the hemodynamics, the surgical debridement should never be delayed because until and unless the necrotic tissue is completely debrided, the remission of sepsis cannot occur and hence stable hemodynamics will not be achieved.

Since these patients are always in a state of hypovolemia, aggressive resuscitation with i.v. fluids should be practiced. Crystalloids are the most preferred i.v. fluids. The most common dyselectrolemias found in these patients are hyponatremia and hypocalcemia which needs to be corrected accordingly for better outcome. Aggressive fluid resuscitation will maintain adequate end organ perfusion and tissue oxygenation by restoring intravascular volume and thereby limiting the adverse effect of end organ failure. Intravascular volume status requires monitoring in patients who are old age, are in shock or have underlying cardiac or pulmonary disease.

The initial intravenous antibiotic therapy should be broad spectrum so that it covers a wide variety of causative pathogens.

The current empirical antibiotic regime advocates use of Piperacillin-Tazobactam at 3.35 gm every 6 hour with Clindamycin 400-600 mg every 4-6 hour with Ciprofloxacin 400 mg every 12 hour in Type I infections. For Type II infections, Penicillin (2-4 million units every 4-6 hrs) with Clindamycin is recommended. Injection Linezolid (600mg every 12 hrs) or Vancomycin (30mg/kg/day in 2 divided doses) may be considered in those allergic to Penicillin. For Type III Clostridial infections, combination of Penicillin with Clindamycin is effective. In case of Vibrio or Aeromonas infection, Doxycycline in a dose of 1 gm every 12 hrs is effective.<sup>23</sup>

Clindamycin is indicated for all patients having hypotension, coagulopathy and/or organ system failure as it is a good suppressant of toxin production by organisms like Staphylococcus aureus,  $\beta$  hemolytic Streptococci and Clostridia species.

Surgical exploration is always indicated whenever there is a suspicion of NSTIs. An incision is given over the inflamed and tender area involved and is dissected down till fascia. If the fascia can be easily separated from the fat with blunt dissection (finger test), it will be highly suggestive of necrotizing infection. The normal tough and shiny white fascia changes to a dull gray fascia. Another characteristic features suggestive of NSTIs on surgical exploration is the "dishwater" fluid which is a brownish tan coloured fluid oozing out from the tissues. The surgical debridement should be very aggressive and all the necrotic tissues should be excised so that the excision margin should have healthy bleeding tissue. The wounds are always left open after surgical debridement for open drainage and re-exploration and should never ever be closed.

In 25-50% of the cases when the affected limb is either non-viable or would become dysfunctional after debridement, amputation is recommended.<sup>26</sup>

In cases where there is involvement of the perineum or rectal incontinence, diversion colostomy is done to prevent perineal soiling.<sup>5</sup> Since the blood supply to the testicles are usually preserved in cases of Fournier's gangrene, orchidectomy is rarely required.<sup>27</sup> These patients usually require repeated re-exploration and re-debridement until necrosis and infection is controlled. After appearance of healthy granulation tissues only, wound closures may be planned by direct approximation, skin grafts or flap cover.

### METHODOLOGY

This was a Prospective observational study done at Department of Surgery Unit III, Guru tegh bahadur hospital, Dilshad Garden, Delhi which extended between January, 2017 to December, 2017. 68 patients who were diagnosed to have NSTI on the basis of clinical history, physical examination and surgical exploration as described earlier, were included in the study. Necrotic tissues and the aspirated fluid were sent for microbiological and histopathological analysis. Routine blood investigations for the patients were also sent. Radiological investigations like X rays and CT scans were done for a few suspicious cases. The patients were aggressively resuscitated in form of i.v. fluids, broad spectrum i.v. antibiotics, repeated surgical debridements and other surgical procedures as and when required for different cases. Blood transfusion was done for anaemic cases, and dyselectrolytemias and other coagulopathies were corrected accordingly.

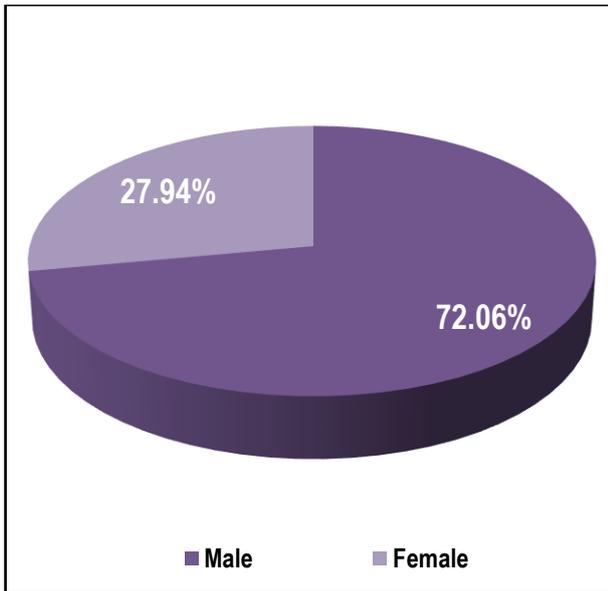


Fig 1: Gender wise prevalence

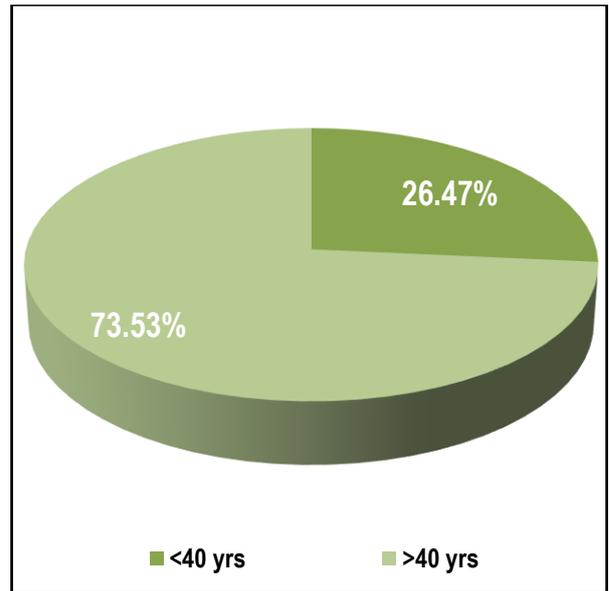


Fig 2: Age wise prevalence

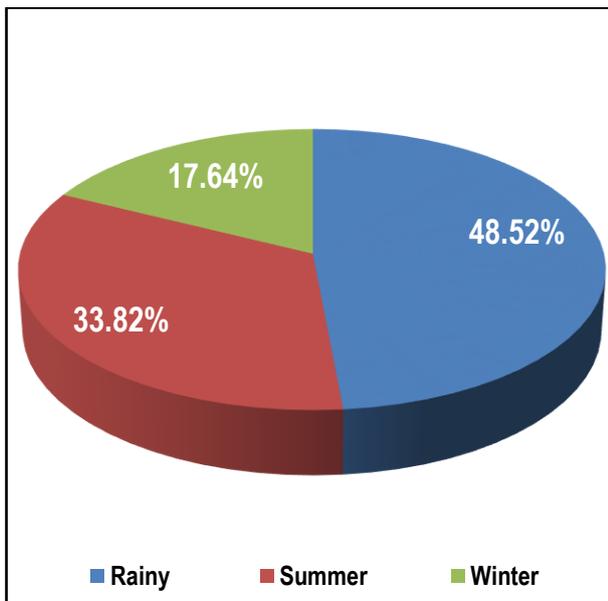


Fig 3: Seasonal variation in prevalence of NSTIs

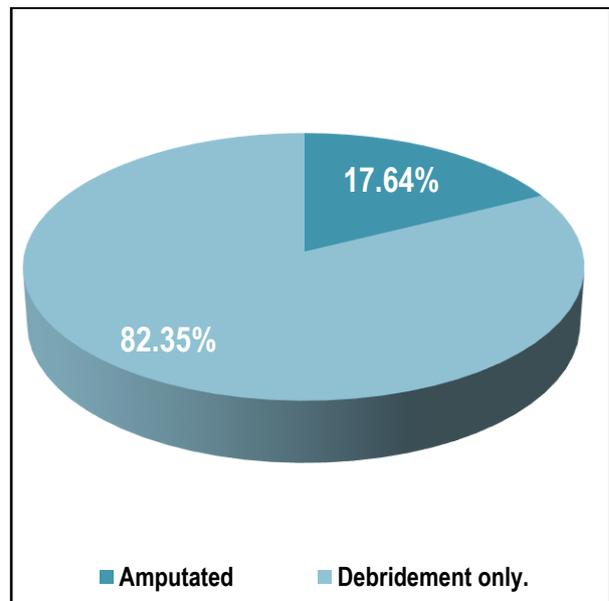


Fig 4: % of cases which needed to undergo amputation

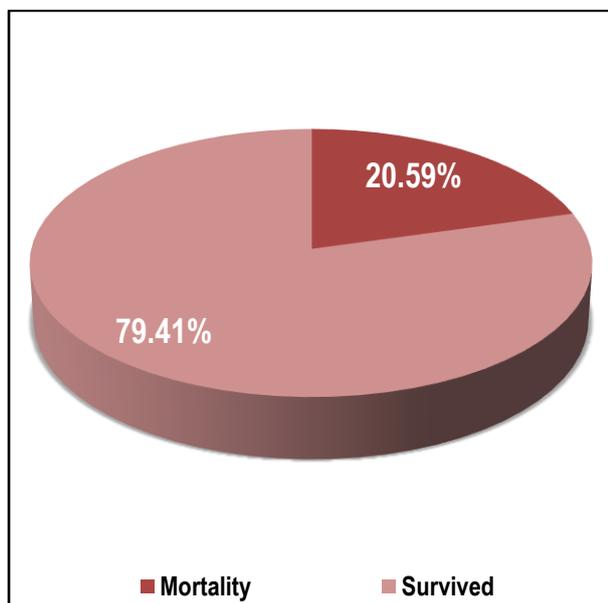


Fig 5: Mortality in cases of NSTIs



Fig 6: NSTI involving the buttock region

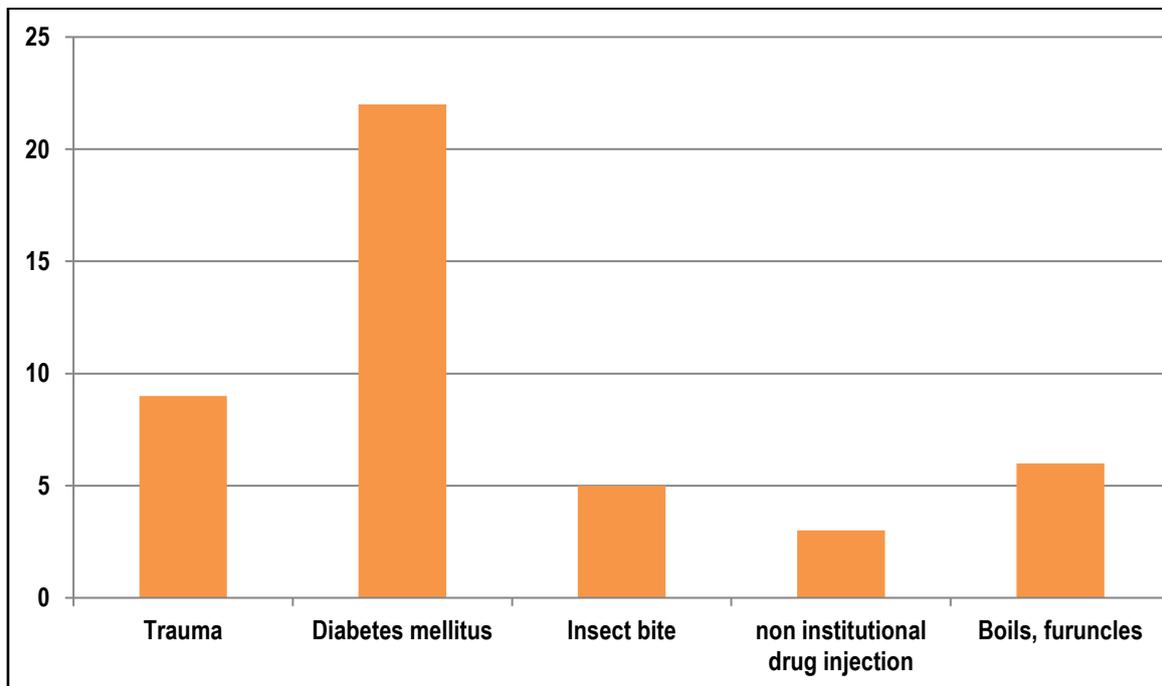


Fig 7: Distribution of risk factors among the NSTI cases

## RESULTS

Out of 68 NSTI cases, 19 were females and 49 were males. Among them, 18 were < 40 yrs of age while 50 were > 40 yrs.

23 patients were previously healthy individuals who were not suffering from any comorbidities while 45 were found to have one or more associated risk factors. Out of these 45 patients, 22 were suffering from Diabetes mellitus, 9 had a history of trauma, 5 gave a history of unknown insect bite, 3 of them had a history of non-institutional drug injection while the rest 6 gave history of boil/furuncle as a predisposing factor.

The maximum number of cases (33) were found to be during the rainy season in the month of July, August and September. In the summer month from March to June, 23 cases were diagnosed while in the winter months extending between October to February, 12 cases were diagnosed.

Out of the 68 cases, 12 patients were taken up for amputation of the affected extremity while the rest 56 were managed by debridements only.

9 (13.23%) patients out of the total were diagnosed as cases of Fournier's gangrene. Among those 9 cases, 4(44.4%) patients needed Diversion colostomy for healing of the wound. None of them needed orchidectomy.

14 patients died among the 68 cases, inspite of our best efforts.

## DISCUSSION

In a study conducted by Iris et al<sup>28</sup>, the prevalence of NSTI among males was found to be 67% whereas in our it was found to be 72.06%. In an another study done by Charles et al<sup>29</sup>, the prevalence of NSTIs among females was 34.1% while in our study it was found to be 27.94%. In the past, the overall mortality rate of NSTI was found to be 46%<sup>30</sup>, which has now decreased to only 12% according to National Surgical Quality improvement programme.<sup>31</sup> In the study conducted by Iris et al<sup>28</sup>, the overall mortality was 14% while in our study it was found to be 20.59%. Similarly in the study conducted by Charles et al<sup>29</sup>, the mortality rate was shown to decrease from 9% in 1998 to 4.9% in 2010.

## CONCLUSION

NSTIs are characterized by progressive and fatal soft tissue infections which need meticulous interdisciplinary approach and complete surgical debridement of the necrotic tissue for optimal results.

In the course of this study, we observed that the patients, who presented to the emergency department in the early stages of the disease, had higher chances of positive outcome and survival. Another important factor for better outcome is the immediate introduction of rigorous treatment, which is possible only when the physicians maintain a high index of suspicion on the basis of preliminary signs and symptoms. The bedrock of the treatment for NSTIs is the radical surgical debridement of all necrotic tissues.

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