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A clinical study of non-diabetic soft tissue infections: risk factors for mortality and morbidity

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ABSTRACT

Background: Non-diabetic soft tissue infection is the infection of the soft tissue in a non-diabetic patient. It is rare, but results in high mortality. The aim of the study was to establish a scoring system to predict the outcome of a patient with non-diabetic soft tissue limb infection at the time of admission and to determine the factors which increase the morbidity of a patient with non-diabetic soft tissue limb infection as determined by number of days of hospital stay or limb loss or death of the patient.

Methods: Clinical and laboratory details of 200 cases of non-diabetic soft tissue infections of the lower limb were retrospectively analyzed statistically, using pearson's chi square test for comparison of proportions with respect to mortality, fisher's exact test, logistic regression analysis were expressed using beta coefficient values, odds ratios. Statistical analysis was performed using SPSS software version 12.

Results: Two hundred patients records were reviewed. 121 patients (60%) were males and 79 (40%) were females. Mean age was 52.5 years ranging from 14 to 91 years. Forty-six patients underwent conservative treatment, 111 patients underwent debridement and 43 patients underwent amputation. Increasing age were the risk factor associated with mortality in non-diabetic soft tissue infections that were statistically significant.

Conclusions: Non-diabetic soft tissue infections still lead to high mortality and morbidity despite the use of appropriate conservative treatment, aggressive debridement, resuscitation and amputation. In this series, there is high mortality associated with increasing age.

Keywords: Increasing age, Mortality, Morbidity, Non-diabetic, Soft tissue infections

INTRODUCTION

Soft tissue skin infections (SSTI's) were first described in the Hippocratic era. In time various surgeons described the disease process in detail. The most well documented among these is the work of Joseph Jones a confederate army surgeon, who reported 2,642 cases of "hospital gangrene" with a mortality rate of 46%.¹

Since then, multiple reports and classification systems have been published in an attempt to define this disease better and achieve lower mortality rates with better outcomes. Skin and soft tissue infections (SSTI) are

classified into complicated and uncomplicated infections.²

Uncomplicated SSTI's include cellulitis, erysipelas, simple abscesses, impetigo, ecthyma, folliculitis, furunculus's and carbuncles. They are superficial infections and have a low mortality and morbidity (limb loss). They can be treated by antibiotic therapy and drainage procedures.

Complicated SSTI's includes necrotizing soft tissue infections, complicated abscesses, infected burn wound, infected ulcers, infections with significant underlying

disease states that complicates response to treatment (e.g. DM). These are usually deeper infections with higher mortality and morbidity, (i.e.) a higher chance of limb loss.³ Necrotizing soft tissue infections by definition include the presence of necrotic or devitalized tissue as part of the pathophysiology.4 Skin and soft tissue infections have been described since 5th century BC. The first clear reference to necrotizing fasciitis (NF) dates back to the 5th century BC, with Hippocrates' description of a fatal infection, "Many were attacked by the erysipelas all over the body when the exciting cause was a trivial accident. The erysipelas would quickly spread widely in all directions. Flesh and bones fell away in large quantities. Fever was sometimes present and sometimes absent. There were many deaths. The course of the disease was the same to whatever part of the body it spread".5 The principles of management, including early diagnosis with prompt and repeated surgical debridement, aggressive resuscitation and physiological support, broad spectrum antimicrobial drugs, and nutritional support, have been well documented. Despite this well accepted management approach, the mortality rate remains between 16-34% in most major published series. Over the last decade, there has been an interest in understanding SSTIs better. Some investigators have focused on methods that aid in early diagnosis so that surgical debridement can be accomplished promptly, whereas other researchers have focused on identifying patients at higher risk of death. Although several predictors of death have been identified, differences in patients across series limit their broad applicability. Due to the lack of defined criteria to determine the type of treatment that has to be given for patients at the time of admission, most patients undergo multiple surgical procedures which increases the morbidity and mortality. The primary objective of this analysis is to create a simple clinical score to aid in the prediction of morbidity defined by the number of days of hospital stay or limb loss and mortality in patients with SSTIs at the time of first assessment. The scoring system may further be used to predict limb loss at first assessment, thereby reducing multiple surgeries for the same patient.

METHODS

The study was carried out in Saveetha medical college and hospital, Chennai, India. A retrospective record review of all 200 patients with non-diabetic soft tissue infections, who were treated at Saveetha medical college and hospital between September 2015 to September 2016 was done with inclusion criteria as follows: Patients with soft tissue infections of the lower limbs including cellulitis, abscesses, necrotising fasciitis. The exclusion criteria were patients with diabetes, either known cases or newly diagnosed, x-rays showing osteomyelitis changes, patients who had prior surgeries for the same problem elsewhere were also excluded from the study. Patients were identified using a computer-generated search through the medical records department. The following methods were used for the study which includes, patients

detail history, clinical examination. The following laboratory data variables were evaluated and compared between survivors and non survivors and also between those who underwent a limb salvaging procedure or an amputation as follows: Age in years, gender of the patient, duration of symptoms prior to admission in days, comorbid conditions, glascow coma scale at admission, presence of sepsis as determined by the presence of two or more of the following- fever/hypothermia, raise/fall of total leukocyte count, tachycardia and tachypnoea, requirement of ventilator support at admission, urea and creatinine at admission, erythrocyte sedimentation rate at admission, total bilirubin at admission, surface area of body involved, haemoglobin in gm% at admission and depth of involvement. Because of the large number of parameters, logistic regression analysis used. The variables found on logistic regression analysis were used to form a scoring system. This score was then reapplied to the retrospective study to analyse the actual outcome with the expected outcome. After taking the difference between the expected and actual outcomes into account, cut offs for the scoring system were established. To assess possible risk factors for morbidity and mortality, univariate analyses were completed initially to aid in determining the variables that should be included in a stepwise logistic regression model. Comparisons of proportions were made using Pearson's chi square statistic to identify univariate differences among defined variables with respect to mortality. Fisher's exact test for 2x2 tables was used in the small-sample case. For measured variables, the F statistic was used to compare means between survivors and non-survivors. Clinically relevant variables were selected from the large pool of variables with uni variate p values less than 0.05 for inclusion in the initial step of the logistic regression analysis. A p value of 0.05 also was chosen as the criterion by which to judge the entry and removal of variables at each step of the regression procedure. Results of the logistic regression analysis were expressed using beta coefficient values, odds ratios and 90% confidence limits for the odds ratios. Statistical analysis was performed using SPSS software version 12.

RESULTS

Two hundred patients records were reviewed. One hundred and twenty-one patients (60%) were males and seventy-nine (40%) were females (Figure 1). Mean age was 52.5 years ranging from 14 to 91 years (Figure 2). Among the 46 patients underwent conservative treatment, 44 had a score of less than 13 and only 2 patients had a score of 14. The average no. of days of hospital stay in this group was 4.76 days. Among 111 patients underwent debridement, 2 patients had a score of 12 and 17 patients had a maximum score of 19. Majority of patients had a score of 17 and 18. Average number of days of hospital stay in this group was 10.1 days. Two patients expired in this group and both had a score of 19. Among the 43 patients underwent amputation, three patients had minimum score of 13 and six patients had maximum

score of 24. Average number of days of hospital stay was 12.19 days. Six patients expired in this group, one with a score of 24 and 5 with a score of 22. Based on this evaluation cut offs were established for the scoring system. Patients with a score less than or equal to 13 would be treated conservatively. Any patient with a score between 14 and 19 would be treated with extensive debridement and patients with a score greater than or equal to 20 would undergo an amputation. Increasing age were the risk factor associated with mortality in non-diabetic soft tissue infections that were statistically significant.

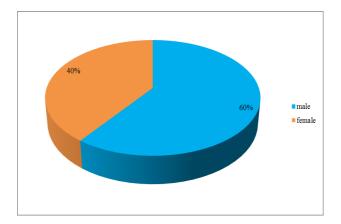


Figure 1: Sex wise incidence of non-diabetic soft tissue infections.

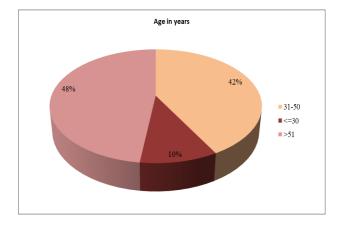


Figure 2: Age wise incidence of non-diabetic soft tissue infections.

DISCUSSION

Necrotizing soft tissue infections of the skin have been reported to have a high morbidity and mortality. In 1924, Meleney noted a mortality rate of 20% out of 20 patients.⁶

The mortality rate of 20% in the present series is slightly lower than the cumulative mortality of 34% as reported in the Mchenry et al. study. Wong et al., in their series of 89 patients, 70% involving lower limbs, have a mortality rate of 21.3%. Singh et al., in their series of 55 patients

(31 involving lower limbs) reported a mortality of 27.2%. Pang et al., with 24 patients with necrotizing fasciitis of the limbs, in which 12 involved the lower limbs, reported a mortality of 33.3%. As we know necrotizing fasciitis of the lower limbs are more amenable for local control as amputation can be performed to control the local effect of the disease, whereas necrotizing fasciitis that involves trunk and genitourinary systems is more difficult to control since wound debridement hindered and not as thorough because it involves vital organs. Thus, lower limb involvement gives a more favourable outcome and a lower mortality rate.

In the current study, we studied various parameters which are considered risk factors for morbidity and mortality by various authors. Several authors reported that patients above the age of 60 were associated with higher mortality.7,11,12 Our study showed that an age above 51 years increased the morbidity and mortality of the patients. Other confounding factors must be taken into consideration as elderly patients are predisposed to illnesses such as diabetes mellitus and renal failure and their immunological status is generally poorer, all of which may contribute to the higher mortality rate. According to our study gender of the individual did not contribute to morbidity or mortality, contrary to results reported by Elliot et al.13 Initial presentation of necrotizing fasciitis is easily confused with other milder soft tissue infections such as cellulitis which require only a conservative treatment approach.

Unfortunately, this can delay definitive treatment of debridement or amputation. According to our study a duration of greater than five days duration between initial symptoms and surgical procedure is associated with a higher rate of morbidity and mortality similar to the results of Eckmann *et al.*, who that noted those with a duration of initial symptoms to surgical treatment of more than 5 days were associated with a higher mortality rate. ¹⁴ Although little can be done to influence the time between a patient development of symptoms and receipt of medical attention except to increase public awareness through education, measures can be taken to hasten the diagnosis and early operative debridement.

Wong *et al* developed a screening system for necrotizing fasciitis with a high predictive value that is helpful in making an early diagnosis, leading to situations where definitive treatment can be carried out as early as possible. The presence of sepsis at the time of admission was defined by the presence of two or more of the following, increase or decrease of body temperature, increase or decrease of total leukocyte count, tachycardia and tachypnoea. There was significant effect of temperature on admission on morbidity and mortality in the present study, similar to results published by Bosshardt et al., in which high admission temperature was identified as a risk factor of mortality. ¹⁵

Author did not find that admission blood pressure affected mortality, contrary to reports by Bosshart et al and Fustes-Morales et al. who identified low blood pressure as a determinant for mortality. ^{15,16} The presence of co morbid condition apart from Diabetes mellitus was found to significantly contribute to the morbidity and mortality as was seen in the study by Brand et al and Elliot et al. ^{14,7}

The consciousness of the patient as assessed by the Glasgow coma scale at the time of admission showed that a GCS of less than 13 affected the morbidity and mortality adversely, more so if the GCS was less than 8. This was similar to the results of Darke et al, who showed that a GCS of less than 7 significantly affected the mortality.¹⁷

The surgical literature has been divided regarding the impact of extent of infection on survival; in this study, patients with less extensive infection, expressed in terms of body surface area involved (much as for burns), had a definite survival advantage, whereas such an association was not borne out in the study of 57 patients with Fournier's gangrene by Clayton et al. ¹⁸ Similarly depth of infection adversely affected the mortality in our study. But there are no similar results in any published studies.

In many other published reports, no instances of myonecrosis were even reported; in others, it was rare.^{15,17} Among the lab parameters that were studied, haemoglobin was found to adversely affect the morbidity and mortality if it was less than 8. This was similar to the results published by Patino et al.¹⁹

According to our study blood urea, serum creatinine, erythrocyte sedimentation rate or total bilirubin values at the time of admission were not significant contributory factors to morbidity and mortality. The scoring system established by our study did not affect mortality. The usage of the scoring system in the prospective study showed a significant reduction in the number of procedures required by a patient. Even 101 though the usage of the scoring system showed a decrease in the number of days of hospital stay, the decrease was not statistically significant.

CONCLUSION

Non-diabetic soft tissue infections still lead to high mortality and morbidity despite the use of appropriate conservative treatment, aggressive debridement, resuscitation and amputation. In this series, there is high mortality associated with increasing age.

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Institutional Ethics Committee

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