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Original Research Article

A study on role of laboratory risk indicator for necrotizing fasciitis score in necrotizing fasciitis

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ABSTRACT

Background: Necrotizing fasciitis (NF) represents a group of highly lethal infection characterized by rapidly progressing inflammation and necrosis. The spectrum of disease ranges from necrosis of the skin to life threatening infection. Laboratory risk indicator for necrotizing fasciitis (LRINEC) score is only scoring system available so far to help us towards making an early and accurate diagnosis.
Methods: The current prospective observational study was conducted in the Surgery OPD and emergency, Department of surgery, Dr. B.R. Ambedkar Memorial Hospital, Raipur, CG, India, during study period October 2017 to September 2018. Sample size was fixed at 100. Blood tests taken on admission were used to calculate the LRINEC score in each case.
Results: In this study 55% of patients with soft tissue infections were categorized as low risk for progression of NF. Necrotizing soft tissue infection (NSTI) occurs in all age groups, ranging from 18 to 75 years. Clinical findings of crepitus were found in 33% of all patients of NSTI. 96% of the patients underwent debridement once, debridement was done twice in 3% of the patients while debridement was not done in 1% of the patients who belonged to high risk group and had no comorbidities. Out of 100, 3 patients underwent amputation. We found that there is mortality rate of 5%.
Conclusions: NF was most severe form of soft tissue infection, potentially life and limb threatening. Early diagnosis of NF is essential for early management and better prognosis of patients.

Keywords: Necrotizing fasciitis, LRINEC score, Soft tissue infection, Immunocompromised

INTRODUCTION

Necrotizing fasciitis (NF) represents a group of highly lethal infection characterized by rapidly progressing inflammation and necrosis. The spectrum of disease ranges from necrosis of the skin to life threatening infection. NF involves extensive necrosis of soft tissue compartment (dermis, subcutaneous tissue, superficial and deep fascia) due to bacterial infections, spreading along the fascial plane. The pathogenesis is not yet fully elucidated. It is typically believed to be caused by toxin producing bacteria and extensive inflammatory response is thought to be the main cause of tissue pathology, systemic shock, septic shock, multiple organ failure and mortality. As the disease progresses, thrombosis of the affected cutaneous perforators subsequently de-vascularizes the overlying skin causing skin ischaemia and necrosis. Bacteraemia and sepsis invariably develops when the infection is well established.[1-4]

The incidence of necrotizing soft tissue infection (NSTI) has increased over the past decade and is estimated to be

40 cases per 1,00,000 person-years with 4.8 deaths per 1,00,000 person-years in the united states. Despite aggressive treatment the reported case fatality rate for NF remains high at a cumulative rate of up to 34%. In the literature, most NF patient have pre-existing medical conditions including peripheral arterial occlusive disease, myelodysplastic syndrome, liver cirrhosis and other immune suppressive conditions. Diabetes mellitus (DM) has been reported to be a common underlying disease in NF patients, accounting for 44.5-72.3% in various series. Diabetic patient's exhibit impaired cutaneous wound healing and increased susceptibility to infections, which may affect the course of soft tissue infections. It is thus responsible to speculate that this chronic debilitating disease contributes to a more serious nature of NF.[5,6]

The only factor shown to decrease mortality in various studies done so far is early surgical intervention. However since it is difficult to differentiate from other soft tissue infection, it is mostly delayed.[7]

Laboratory risk indicator for necrotizing fasciitis (LRINEC) score is only scoring system available so far to help us towards making an early and accurate diagnosis. According to Wong et al, LRINEC score can classify patients into high-risk and moderate-risk categories. Other diagnostic tests and symptoms in early phase have been proposed such as radiographic visualization of gases in the tissue, presence of crepitus or bullae, but surgical exploration seems to be the gold standard for the diagnosis.[8,9]

The optimum multi-modal treatment consists of hemodynamic stabilization and supportive intensive care if necessary, broad spectrum antibiotic therapy and extensive surgical debridement of necrotic tissue.[10-13]

The aim of the present study was to assess the role of LRINEC score for early diagnosis and management of NSTI.

METHODS

The current prospective observational study was conducted in the surgery OPD and emergency, Department of surgery, Dr. B.R. Ambedkar Memorial Hospital, Raipur, CG, India, during study period October 2017 to September 2018. Sample size was fixed at 100. Ethical consideration was made through institutional ethical committee and informed consent was taken from the subjects prior to study.

Determination of the sample size was by the formula

$$\text{Sample size}=\frac{\frac{z^2\times p(1-p)}{c^2}}{1+\frac{z^2\times p(1-p)}{nc^2}}$$

where, Z=Z value i.e., standard deviation; p=proportion of population; n=population size; c=confidence interval expressed as decimal.

Inclusion criteria

Patient presenting to surgery OPD and casualty Dr. Bhim Rao Ambedkar Memorial Hospital, Raipur with symptoms suggestive of soft tissue infection. Patient who has given consent for study were included in the study.

Exclusion criteria

Patients below 15 years or above 75 years of age and who have received antibiotic treatment in last 48 hours or a maximum of 3 doses of antibiotic prior to presentation. Patients who has undergone surgical debridement for present episode of soft tissue infection. Patients with boil or furuncles with no evidence of cellulitis were excluded from the study.

Blood tests taken on admission were used to calculate the LRINEC score in each case. Data was recorded in MS Excel and checked for its completeness and correctness then it was analysed by suitable statistical software.

RESULTS

In this study 55% of patients with soft tissue infections were categorized as low risk for progression of necrotizing fasciitis. Whereas, 24% and 21% of patients with soft tissue infections were categorized as intermediate and high risk for progression of necrotizing fasciitis respectively (Table 1).

Table 1: LRINEC score categorization and frequency of patients.

LRINEC score	Risk group	Frequency	%
0-6	Low	55	55
6-8	Intermediate	24	24
>8	High	21	21
Total		100	100

In our study, NSTI occurs in all age groups, ranging from 18 to 75 years. It appears that most commonly involved age group is 46 to 60 years (43%) and next common age group involves 60 to 75 years (25%), followed by 31 to 45 years (21%) the least incidence is seen in age group of 18 to 30 years (11%).

In the study population of 100 patients with necrotizing soft tissue infections, 81% of the population was males and the rest of the population was female (19%) (Table 2).

Among our study population 71% of patients had spontaneous onset of NSTI and rest of the 29% had

preceding history of injury. 34% of the patients have history of DM.

Table 2: Background characteristics of study subjects.

Background characteristics		Frequency	%
Age group (in years)	18-30	11	11
	31-45	21	21
	46-60	43	43
	60-75	25	25
Sex	Female	19	19
	Male	81	81
Total		100	100

In our study group, total of 7% of the patients are hypertensive and total 3% of the patients of NSTI have peripheral vascular disease. Also, the percentage of immunocompromised is just 5% among the study patients (Table 3).

Table 3: Variables associated with study subjects.

Variables		Frequency	%
Etiology	Spontaneous	71	71
	Traumatic	29	29
DM	Absent	66	66
	Present	34	34
HTN	Absent	93	93
	Present	7	7
PVD	Absent	97	97
	Present	3	3
Immunity status	Immuno compromised	5	5
	Non-immuno compromised	95	95
Total		100	100

DM: Diabetes mellitus; HTN: Hypertension; PVD: Peripheral vascular disease.

Table 4: Clinical findings among study subjects.

Clinical findings		Frequency	%
Necrosis	Absent	54	54
	Present	46	46
Crepitus	Absent	67	67
	Present	33	33
Discharge	Absent	20	20
	Present	80	80
Edema	Absent	74	74
	Present	26	26
Inflammation	Absent	2	2
	Present	98	98
Total		100	100

Among study patients, tissue necrosis was present in 46%. In the study patients, clinical findings of crepitus were found in 33% of all patients of NSTI. Among the study patients, discharge is seen 80% of the patients. In the study groups, patients with clinical findings of edema are found in 74% of all patients with NSTI. In our study patients, patients in all the risk groups showed signs of inflammation (Table 4).

Among the patients 66% and 34% had C-reactive protein (CRP) score of 0 and 4 respectively, 17%, 21% and 62% Hb score of 0, 1 and 2 respectively. In our study, among the patients 51%, 22% and 27% had score of 0, 1 and 2 respectively. Serum creatinine is one of the important parameter. 84% have serum creatinine values of <1.6 mg/dl, while 15% have values of >1.6 mg/dl respectively. 13% of the total patients had score of 2 for random blood sugar (>180 mg/dl). 87% of the total patients had score of 0 for random blood sugar (RBS) (<180 mg/dl). In our study group, 61% of the patients had sodium score of 2 (<135 mEq/l) and 39% of the patients had score of 0 (≥135 mEq/l) (Table 5).

Table 5: Laboratory findings of the study subjects.

Laboratory findings		Score	Frequency	%
CRP level (mg/dl)	0 (CRP value <150 mg/dl)	0	66	66
	4 (CRP value >150 mg/dl)	4	34	34
Hb level (gm%)	>13.5	0	17	17
	11-13.5	1	21	21
	<11	2	62	62
WBC level (×1000 cells/µl)	<15	0	51	51
	15-25	1	22	22
	>25	2	27	27
Creatinine values	<1.6	0	85	84
	>1.6	2	15	15
RBS value (mg/dl)	<180	0	87	87
	>180	2	13	13
Sodium levels	≥135	0	39	39
	<135	2	61	61
Total			100	100

Table 6: Management and outcome among study subjects.

Management and outcome		Frequency	%
No of debridement	No debridement	1	1
	Debridement done once	96	96
	Debridement done twice	3	3
Culture positive	Present	100	100
	Absent	0	0
Progressed	No	83	83
	Yes	17	17
Regression	No	17	17
	Yes	83	83
Amputation	No	97	97
	Yes	3	3
Mortality	No	95	95
	Yes	5	5

In our study, 96% of the patients underwent debridement once, debridement was done twice in 3% of the patients (2 belonged to low risk and 1 belonged to intermediate risk group) while debridement was not done in 1% of the patients who belonged to high risk group and had no comorbidities. Of those who underwent debridement twice, DM was present in 66% and HTN was present in 33%. NSTI progressed in 17% of the patients. The percentage of NSTI patients who showed regression are 83%. Out of 100, 3 patients underwent amputation. We found that there is mortality rate of 5% (Table 6).

DISCUSSION

Necrotizing soft tissue infection is severe rapid progressive, life and limb threatening infection process, more prevalent among patients with DM. The associated systemic inflammatory response in sepsis causes significant changes in biochemical parameters in a predictive manner.

LRINEC scoring system is a measure of biochemical disturbances predicts the presence of NF. In other soft tissue infections (cellulitis, abscess, furuncles) rarely causes an inflammatory response enough to cause such changes in laboratory variables.

In our study with 100 patients with NSTI, the peak incidence was found in the age group of 46-60 years, with a mean age of 53 years, with a sex ratio of 81:19 between male and females respectively. Glass et al conducted a study on twenty-four patients with histologically confirmed NSTI and found that there were two age clusters with mean age of 46 years and 80 years, with a sex ratio of 16:8 between male and female respectively. A third of younger patients had human immunodeficiency virus or hepatitis C, with a quarter dependent on drugs and/or alcohol.[14]

In our study with 100 patients with NSTI, 3% underwent amputation of the involved limb, as it could not be salvaged.

Surahio et al conducted a study of total of 1,507 patients with a diagnosis of NF. The number of cases which underwent amputation were 8.4% (n=127) and without amputation were 91.6% (n=1,380).[15]

Glass et al conducted a study on twenty-four patients with histologically confirmed NSTI and found that five patients died.[14] A total of 1,507 patients with a diagnosis of necrotizing fasciitis were classified as being with amputation (n=127, 8.4%) and without amputation (n=1,380, 91.6%).

In a study conducted, Ramin et al on 24 patients, twelve patients (50%) improved, while seven patients (29.2%) were complicated by limb loss. Mortality rates related to upper and lower limb involvement were similar (20% vs. 22.2%).[16]

High risk patients, have more chances of going to complication or death. The cut off of LRINEC >8 has better sensitivity and specificity to identify the risk of the patients with NSTI.

Gaby et al conducted a retrospective study at a single surgical intensive care unit with 331 cases of NF. Despite the advanced medical treatment, the rate of mortality was found to be as high as 24-34%.[17]

Glass et al conducted a study on twenty-four patients with histologically confirmed NSTI and found that Group A *Streptococcus* was the most frequently identified pathogen.[14]

In our study, the pus culture report found polymicrobial organism in majority of the patients (85%) and mono microbial in rest of the patients (15%). Among the mono-microbial includes the following organisms, *Escherichia coli* (5%), *Staphylococcus* (2%), *Streptococcus* (3%), *Klebsiella* (4%), *Pseudomonas aerugenosa* (1%). Among the diabetic patients most common monomicrobial organism was found to be *Klebsiella pneumoniae*.

Chen et al, conducted a study on 165 cases of NF and found that polymicrobial and monomicrobial infection with *Klebsiella* species were more common in those patients with diabetes. *Staphylococcus* was found in 26 patients, followed by *E. coli* in 17 patients.[18]

CONCLUSION

NF is most severe form of soft tissue infection, potentially life and limb threatening. Early diagnosis of necrotizing fasciitis is essential for early management and better prognosis of patients. LRINEC score requires routine laboratory investigations and that are readily available at most of the health centers. This score can help in distinguishing NF from other soft tissue infections. LRINEC scoring system has a better positive predictive value in identification of the patients of NF and classification of the patients with severe soft tissue infection into low, intermediate and high risk groups to start early and appropriate intervention. The LRINEC score can help in predicting the prognosis of the patient as well as the mortality. Finally, LRINEC score can help in preventing delayed referral of the patients with NSTI to higher center where experienced surgeons and specialists may guide for immediate operative management, thereby improving the prognosis of the patients.

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