Section: General Surgery

Research

CLINICAL AND LABORATORY PREDICTORS OF NECROTISING FASCIITIS IN PATIENTS PRESENTING WITH SOFT TISSUE INFECTION

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Abstract

Background: Lower extremity (LE) necrotising soft tissue infection (NSTI) is a life-threatening illness that can spread fast if not treated quickly enough. Hence, to study the predictive accuracy of clinical and laboratory predictors of necrotising fasciitis for early diagnosis and management. **Materials and Methods:** A Cross-sectional study was conducted at the Department of General Surgery, ESIC Medical College & PGIMSR, KK Nagar, Chennai, from March 2020-November 2021. Seventy patients presenting with soft tissue infection suspected of Necrotising fasciitis were selected. Written informed permission was acquired from patients after they were given information about the study's objectives. **Result:** All the patients were males in the study, 70 (100%). In the type of wounds, the Diabetic foot ulcer was 42 (60%), and cellulitis was 13 (18.6%). In clinical predictors, Necrotic patch was 33 (47.1%), crepitation was 32 (45.7%), oedema extended beyond skin erythema was 32 (45.7%), Haemorrhagic bulla was 30 (42.8%), and Toxicity was 26 (37.1%). 58.6% of the patients had wounds on the left foot and 41.4% on the right foot. In association with the HPE category, there is a significant difference in the Total count, Serum sodium, C-reactive protein, ESR, HbA1C, and N/L ratio with Necrotising Fasciitis (p=0.011), (p=<0.001), (p=<0.001), (p=<0.001), (p=0.009), and (p=<0.001). There is no significant difference in Haemoglobin, Serum glucose, and Creatinine with Necrotising Fasciitis (p=0.115), (p=0.062), and (p=0. 9). **Conclusion:** We conclude that treating patients with clinical and laboratory parameters must be considered for clinical outcome prediction.

INTRODUCTION

The invasion of microorganisms into the dermal and subdermal layers of the skin and the underlying soft tissues constitutes the clinical entity known as skin and soft tissue infection (SSTI), which can manifest in various ways and be quite severe. For example, necrotising fasciitis is a potentially fatal form of SSTI that can manifest in various ways, from a mild skin infection called pyoderma.[1] The minimum diagnostic criteria are warmth, erythema, oedema, tenderness, and discomfort. Depending on the degree of the Illness, the affected area (Upper or lower limb) may become dysfunctional. A patient's co-morbidities, such as AIDS and Diabetes, can quickly turn a normally mild infection into a life-threatening hazard.[2] SSTIs present a wide range of clinical challenges that necessitate management strategies that effectively and efficiently distinguish between those cases that require immediate intervention and attention (medical or surgical) and those that do not.[3]

Necrotising fasciitis (NF), often called flesh-eating sickness, is a bacterial illness that kills soft tissues. Suddenly and rapidly, this lethal disease develops and kills many people. Extreme pain, reddened or purple skin at the site of infection, fever, nausea, and vomiting are typical. The most common sites of infection are the extremities and the perineum. In most cases, a cut or burn is an entry point for the infection.[4] Risk factors include conditions that

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compromise the immune system, such as diabetes and cancer, being overweight, drinking excessively, using intravenous drugs, and having poor peripheral circulation. It's difficult to diagnose early on since the symptoms often mimic those of a minor skin illness. Necrotising fasciitis is a potentially fatal infection that cannot be ruled out by laboratory or imaging techniques. The diagnostic gold standard is an exploratory surgery performed in a highly susceptive environment.[5]

The sensitivity of diagnosing necrotising soft tissue infection is 90% when the white blood cell count is > 15,000 cells/mm3, and the serum sodium level is < 135 mmol/l. Several scoring systems are being developed to predict the risk of necrotising fasciitis.[6] The LRINEC score (Laboratory Risk Indicator for Necrotising Fasciitis) can be used to determine the presence of necrotising fasciitis in patients exhibiting signs of severe cellulitis or abscess. It makes use of the following six laboratory values: Creatinine, C-reactive protein, haemoglobin, total white blood cell count, and blood glucose levels are tests that can be performed.[7] Hence, this study is conducted to find the laboratory and clinical predictors of necrotising fasciitis.

AIM

To study the predictive accuracy of clinical predictors and laboratory predictors of necrotising fasciitis for early diagnosis and management.

MATERIALS AND METHODS

A Cross-sectional study was conducted at the Department of General Surgery, ESIC Medical College & PGIMSR, KK Nagar, Chennai, from March 2020-November 2021. Seventy patients presenting with soft tissue infection suspected of Necrotising fasciitis were selected. Written informed permission was acquired from patients after they were given information about the study's objectives. Patients aged 15-65 years were included in the study.

Exclusion Criteria

Age <15 and >65 years, patient with simple boil/ carbuncle/ furuncle, autoimmune disease, acute limb ischemia, a venous ulcer, and arterial ulcer.

Study participants were admitted to the ward, and routine lab samples were taken as the lab predictors of necrotising fasciitis. Patients were treated with IV antibiotics, IV fluids, +/- surgical debridement, regular wound cleaning and dressing and other supportive treatments. In addition, skin biopsy from the necrotic patch or erythematous skin was taken for all patients and sent for HPE. Based on HPE reports, patients who were thought to have necrotising fasciitis were split into two groups., Group 1: Confirmed Necrotising fasciitis and Group 2: No-Necrotising fasciitis.

Patients' general information like name, age and gender were obtained orally. Total WBC count, haemoglobin, serum sodium, serum glucose, creatinine, and C- reactive protein were scored as per LRINEC.28 ESR values above 20mm/hr and HBa1C value above 6.5%.

Categorical variables were expressed proportionally, and numerical variables were expressed in mean with SD. Lab and clinical parameters of both groups will be plotted in ROC to find the diagnostic accuracy of the respective clinical and laboratory indicator in the diagnosis of Necrotising fasciitis.

RESULTS

All the patients were males in the study, 70 (100%). In the type of wounds, the abscess was 8 (11.4%), cellulitis was 13 (18.6%), Diabetic foot ulcer was 42 (60%), and Necrotising fasciitis was 7 (10%). In clinical predictors, crepitation was 32 (45.7%), Necrotic patch was 33 (47.1%), Haemorrhagic bulla was 30 (42.8%), Toxicity was 26 (37.1%), Progression of disease despite aggressive antibiotics was in 14 (0.2%), and oedema extended beyond skin erythema was in 32 (45.7%) [Table 1].

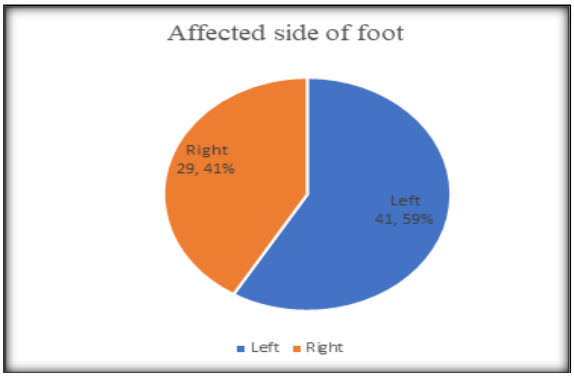

Figure 1: The affected side of the foot

In the study, 58.6% of the patients had wounds on the left foot, and 41.4% had wounds on the right foot [Figure 1].

In association with the HPE category, there is a significant difference in the total count with Necrotising Fasciitis (p=0.011). There is no significant difference in Haemoglobin with Necrotising Fasciitis (p=0.115). There is a significant difference in Serum sodium with Necrotising Fasciitis (p=<0.001). There is no significant difference in Serum glucose with Necrotising Fasciitis (p=0.062). There is no significant difference in Creatinine with Necrotising Fasciitis (p=0.9). There is a significant difference in C-reactive protein with Necrotising Fasciitis (p=<0.001). There is a significant difference in ESR with Necrotising Fasciitis (p=<0.001). There is a significant difference in HbA1C with Necrotising Fasciitis (p=0.009). There is a significant difference in the N/L ratio with Necrotising Fasciitis (p=<0.001) [Table 2].

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Table 1: Distribution of patient's characteristics.

Variable		Frequency (%)
Gender	**Male**	**70 (100%)**
Type of wound	Abscess	8 (11.4%)
	Cellulitis	13 (18.6%)
	Diabetic foot ulcer	42 (60%)
	Necrotising fasciitis	7 (10%)
Clinical predictors	Crepitation	32 (45.7%)
	Necrotic patch	33 (47.1%)
	Haemorrhagic bulla	30 (42.8%)
	Toxicity	26 (37.1%)
	Progression of disease despite aggressive antibiotics	14 (0.2%)
	Oedema extended beyond skin erythema	32 (45.7%)

Table 2: Distribution of parameters associated with the HPE category

Parameters	Mean and Std deviation		P-Value
	Cellulitis	Necrotising Fasciitis	
Total count	14602.17 ± 1836.004	16046.82 ± 2720.215	0.011
Haemoglobin	10.71 ± 1.502	10.14 ± 1.515	0.115
Serum sodium	135.83 ± 5.940	125.50 ± 6.748	<0.001
Serum glucose	157.17 ± 32.017	144.18 ± 24.583	0.062
Creatinine	1.2817 ± 1.75432	1.3229 ± 0.79343	0.9
C-reactive protein	13.72 ± 6.976	73.65 ± 31.309	<0.001
ESR	14.50 ± 7.788	73.94 ± 28.290	<0.001
HbA1C	5.872 ± 1.3526	6.847 ± 1.6899	0.009
N/L ratio	4.86 ± 1.641	8.94 ± 1.969	<0.001

DISCUSSION

In our study, 47.1% of the study participants had the necrotic patch, and 45.7% had crepitation and oedema extended beyond skin erythema which can be used as a clinical predictor.

According to a study by Kruppa et al., the average age of patients diagnosed with necrotising fasciitis was 60. Their dysfunction and bother indices also dropped dramatically (Short Musculoskeletal Function Assessment). Decreased mental, physical, and social abilities were all linked to ageing (>70 years). As of the last follow-up, 72.7% of patients were still experiencing discomfort.[8]

Wang et al. found the median age was 54, with 67 men (73.6% of the total) and 24 females (26.4%). This indicates the prevalence of necrotising fasciitis among patients older than 50. Thus, increasing age is a risk factor for developing necrotising fasciitis. Liver cirrhosis was the most prevalent co-morbidity, affecting 47 percent of patients, followed by diabetes in 45 (39%). Seventy patients (61%) had a single organism detected, and twenty patients (17%) had numerous pathogens isolated. The major risk factors were albumin concentration, length of hospitalisation, and gender. Considering the lack of cutaneous indications in the early stages of the disease, the findings suggest that a high index of concern and increased vigilance are crucial.[9]

A review article by Bonne et al. states that nothing can surpass early detection and treatment of necrotising soft tissue infection, which are critical for a successful outcome.[10]

Stevens et al. reported that swelling and erythema are present in most cases, but the most common finding is discomfort that is out of proportion to the results.[11]

In a study by Bruun et al., 409 adult necrotising fasciitis cases found that increasing age, being a male, shock and avoiding immunoglobulin administration have a significant association with ninety-day mortality among sepsis patients.[12]

A study by Glass et al., among 24 histologically diagnosed patients with necrotised soft tissue infection, found that pain and erythema are the two common among the study participants. In addition, the most commonplace wound is in the lower extremities. And this study concludes that older people have a poor prognosis.[13]

In our study, almost all patients have wounds in the lower extremities, and 59% of the patients have wounds on the left side. In addition, the mean serum sodium level among necrotising fasciitis was 125, which is lower than the patients not having necrotising fasciitis, and this difference is statistically significant.

In a study by Cohen et al., the mean serum sodium level was 134, which is not so different from the control group. However, the mean serum creatine level among the patients with Necrotising Fasciitis was 1.34, with no statistical significance. This indicates the need for more research in this area.[14]

Our study finds similar results: the mean creatinine level was 1.32, and no statistical significance with patients without Necrotising Fasciitis. Thus, using serum glucose and serum creatine as lab predictors is questionable.

A review article by Sambeek et al. states that aberrant lab findings will always accompany necrotising fasciitis. Of that, the major lab finding is WBC count, total count and C-Reactive protein.[15]

Our study's total count was 15,303, and the mean CRP level was 1.3. Our study also states that a high total count correlates with necrotising fasciitis (p =

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0.011). Similarly, there is statistical significance between CRP and necrotising fasciitis ($p < 0.001$).

In a study by Wu et al., the mean WBC count was 21,200 with a standard deviation of 9000.58. This indicates the several-fold increase in the total count in necrotising fasciitis patients.[16]

Our study states that the mean Hb level among participants was 10.43 grams. In contrast to our study, Wu et al. reported the mean Hb level was 12.2 grams, indicating the prevalence of low Hb levels in our country.16 But our study finds no association between Hb and necrotising fasciitis.

CONCLUSION

In the case of necrotising fasciitis, the average duration of stay is ten days. The at-risk individuals for necrotising fasciitis were male gender and aged more than 55 years. The most common type of wound is the diabetic ulcer. As a lab parameter predictor, total count, serum sodium level, high CRP, increased ESR count, high HbA1c, and high Neutrophil–lymphocyte ratio statistically correlates with necrotising fasciitis. Thus, these clinical and lab parameters must be considered while treating these patients to predict clinical outcomes for effective management.

Limitation

In our study, the adequate sample size was met, which supports the generalizability of results to the target population. A single investigator collected the study participants' data, eliminating interviewer bias in our study. However, in our study, all participants were males, which limits the generalizability because gender distribution influences the results. In addition, this is a cross-sectional study; Thus, the association found in this study is not causation. And this association needs evidence support from similar studies. This study provides new areas which need further research.

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