

## Necrotizing Fasciitis: Biochemical Markers and Prediction of Mortality

Jaffar AlKhuzaie, MBBCh, MRCS, CABS, FACS\*  
Mariam AlKooheji, MD, MRCS\*\* Huda AlHajari, MBBCh\*\*\*

**Background:** Necrotizing fasciitis (NF) is a rare disease with a high mortality rate. Identifying patients who need critical care and more aggressive treatment is vital to improve survival.

**Objective:** The aim of this study is to evaluate common biochemical markers with NF and its possible use as predictors of mortality in this subset of the population.

**Design:** Retrospective Single-Center Study.

**Setting:** Surgical Department, Salmaniya Medical Complex, Bahrain.

**Method:** Twenty-six patients with NF completed records were reviewed from January 2010 to December 2013. Personal statistics, comorbidities and laboratory data were documented and analyzed.

**Result:** Fifteen (58%) patients survived. Eleven (42%) died; the mortality rate was high in those with albumin levels less than 20 g/L, and with high urea (more than 10mmol/L) and creatinine more than 141 µmol/L.

**Conclusion:** Initial serum albumin levels in patients with NF may strongly predict mortality. Hence, more aggressive management of this subset of patients is the key to decrease the mortality risk.

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Necrotizing fasciitis (NF) of the skin is a rare and potentially lethal infection which tends to progress rapidly through the fascial planes. Infection usually spreads along the muscle fascia due to its poor blood supply; therefore, the skin appears unaffected at the beginning. It is this characteristic that makes this type of infection difficult to diagnose without surgical interference<sup>1</sup>.

Due to its rarity and low numbers, there is not much data about NF in the literature, which makes it a challenging disease to diagnose and treat. Moreover, once diagnosed, there are no indicators of how to categorize these patients and predict mortality to tailor the treatment and initiate earlier ICU critical care.

The aim of this study is to evaluate common biochemical markers in patients with NF and its possible use as predictors of mortality in this subset of the population.

### METHOD

All patients with surgically proven necrotizing fasciitis at our institution from January 2010 to December 2013 were reviewed. The diagnosis was confirmed at surgery by 'dishwater' appearance of fluid, friable deep fascia (greyish), and lack of bleeding of the underlying muscles during debridement. Microbiological swabs were taken from all patients.

The following data were documented: gender, age, comorbidities, symptoms, blood and biochemical markers (complete blood counts, calcium, phosphorus, liver function tests including albumin levels and renal function tests), radiographic investigations and clinical outcome. Data analysis was done using SPSS version 21.

### RESULT

Twenty-six patients were included in the study, 15 (58%) survived. The average age of patients was 50 years (range of 27-78 years) with a male to female ratio of 2:1, see figure 1.

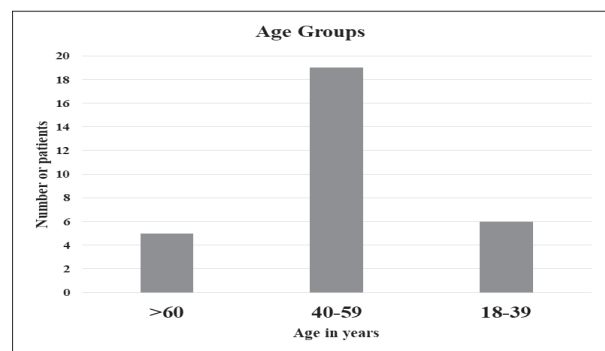


Figure 1: Age Groups

\* Consultant  
\*\* Resident  
Department of General Surgery  
\*\*\* Resident  
Department of Internal Medicine  
Salmaniya Medical Complex  
P.O. Box 12, Manama  
Kingdom of Bahrain  
E-mail: Mariam@alkooheji.net

An initial blood count revealed leukocytosis (total white cell count  $>10 \times 10^9/L$ ) in 23 (88.4%) patients. Fifteen (57.7%) patients had counts more than  $20 \times 10^9/L$ , see figure 2. Fifteen (57.7%) patients had initial bandemia  $<10\%$  which was associated with a lower mortality rate compared to those who had significant bandemia  $>10\%$  on admission, see figure 3.

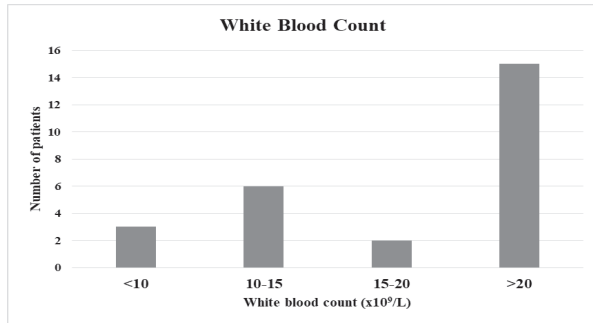


Figure 2: White Blood Count

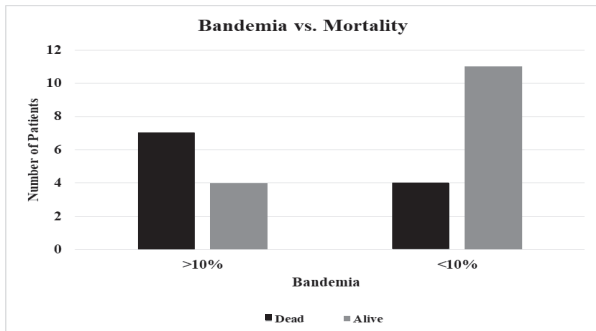


Figure 3: Bandemia versus Mortality

Fourteen (53.8%) patients with serum creatinine less than  $141 \mu\text{mol/L}$  had a lower mortality rate compared to 7 (27%) patients with levels more than  $141 \mu\text{mol/L}$ . Seventeen (65.3%) patients had urea levels less than  $10 \text{ mmol/L}$  on admission; 13 (50%) had survived compared to those with high urea levels.

In patients who were admitted with NF, 10 of the 11 (39%) patients who died had very low albumin levels, less than  $20 \text{ g/L}$ , see figure 4.

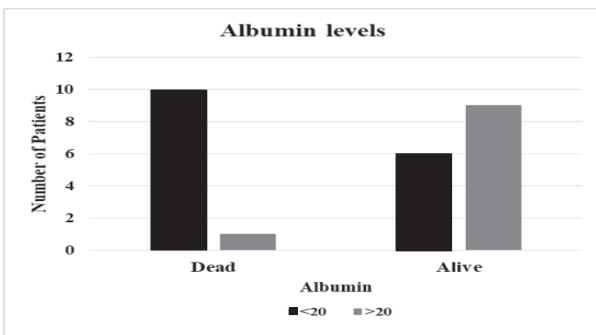


Figure 4: Albumin Levels

The combination of serum albumin less than  $20 \text{ g/L}$ , urea more than  $10 \text{ mmol/L}$ , and creatinine more than  $141 \mu\text{mol/L}$  on admission is a risk indicator, see figure 5.

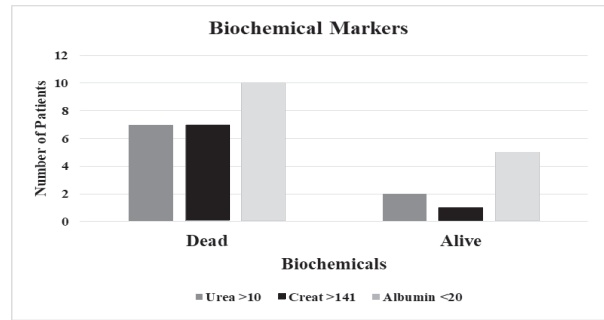


Figure 5: Biochemical Markers

DISCUSSION

Necrotizing fasciitis (NF) was first documented by Hippocrates in 500BC. He documented the clinical feature and complication of erysipelas infection; it is similar to the current description of NF<sup>2</sup>. In 1871, Joseph Jones, an American military surgeon reported 2642 cases of gas gangrene managed in a hospital during the Civil War, with a mortality rate of approximately 46%<sup>3</sup>. This was the first description of ‘modern’ NF in the literature.

NF is a rapidly progressing infection of the skin and soft tissues which causes extensive necrosis of the subcutaneous tissue and the fascia leading to severe systemic toxicity. Until now, studies from individual institutions have been small because of the limited number of patients diagnosed with this condition<sup>4,5</sup>.

Its rarity and lack of pathognomonic signs make NF a diagnostic challenge. Patients usually present with the triad of pain, swelling and erythema, the pain is out of proportion to physical examination<sup>6-9</sup>. It is often misdiagnosed as cellulitis or abscess. Clinicians should have a higher index of suspicion if the patient was diabetic or has liver cirrhosis as the mortality rate of this condition could reach up to 100%<sup>10</sup>.

The Laboratory Risk Indicator for NF (LRINEC) scoring system was established from six routinely performed laboratory tests and used to distinguish NF from the other severe soft tissue infections<sup>11</sup>. However, few studies have observed an association between LRINEC scoring values and outcomes in patients with NF<sup>5,12-16</sup>. There is no prognostic scoring system to determine patients with a higher risk of mortality on initial presentation to the hospital<sup>5,16,17</sup>. Chang et al raised the possibility of the clinical significance of albumin levels ( $2.8 \pm 0.7 \text{ g/dL}$ ) and associated increased mortality risk in patients with NF<sup>18</sup>.

Hypoalbuminemia could be associated with adverse outcomes in patients with a critical illness. We found that albumin levels in the subset of patients who died were very low (less than  $20 \text{ g/L}$ ) compared to those who had levels more than  $20 \text{ g/L}$ ; it is an important biochemical marker which could be used to aggressively treat this category of patients. Chang et al set the diagnostic levels at  $30 \text{ g/L}$ <sup>18</sup>. The combination of serum albumin less than  $20 \text{ g/L}$ , urea more than  $10 \text{ mmol/L}$ , and creatinine more than  $141 \mu\text{mol/L}$  on admission could predict the severity and thereby possible mortality of patients with NF.

The study is limited by the disease rarity and the small sample size. Because of the retrospective nature of the study, there was

difficulty in retrieving full data on patients who had died of NF at the hospital. The study was also limited because it involved only a single center.

## CONCLUSION

**In our study, albumin level is a risk factor of mortality. We found that a combination of serum albumin less than 20 g/L, urea more than 10 mmol/L, and creatinine more than 141 µmol/L is very helpful in identifying patients who need more aggressive management and ICU care. A further multicenter prospective study is needed to support and validate our findings.**

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**Competing Interest:** None.

**Sponsorship:** None.

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