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Local variations in the epidemiology, microbiology, and outcome of necrotizing soft-tissue infections: a multicenter study

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Abstract

BACKGROUND: Necrotizing soft-tissue infections (NSTIs) are rare and highly lethal.

METHODS: A retrospective chart review of patients with NSTIs treated at 6 academic hospitals in Texas between January 1, 2004 and December 31, 2007. Patient demographics, presentation, microbiology, treatment, and outcome were recorded. Analysis of variance, chi-square test, and logistic regression analysis were performed.

RESULTS: Mortality rates varied between hospitals from 9% to 25% (n = 296). There was significant interhospital variation in patient characteristics, microbiology, and etiology of NSTIs. Despite hospital differences in treatment, primarily in critical care interventions, patient age and severity of disease (reflected by shock requiring vasopressors and renal failure postoperatively) were the main predictors of mortality.

CONCLUSIONS: Significant center differences occur in patient populations, etiology, and microbiology of NSTIs, even within a concentrated region. Management should be based on these characteristics given that adjunctive treatments are unproven and variations in outcome are likely because of patient disease at presentation.

Necrotizing soft-tissue infections (NSTIs) are rare, fulminant infections that result in significant morbidity and mortality. A review of 27 case series with 862 patients between 1980 and 1998 estimated mortality to be 32%.[1] Several recent series, including an analysis of over 10,000 patients from the Nationwide Inpatient Sample (NIS) a national discharge database, have reported mortality rates between 10% and 20%.[1–4] Long-term mortality in NSTI survivors is also increased when compared with population-based controls.[5] Furthermore, approximately 20% of NSTI patients require amputations,[6,7] and 30% of patients have mild to severe functional limitations after discharge.[8]

Given the rarity of the disease and heterogeneity in its characteristics, comparison between studies is difficult.

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Mortality rates are dependent on patient characteristics[2,9–15] and the etiologic microbial pathogen(s).[15–17] Additionally, there are regional differences in the epidemiology and microbiology of NSTIs[18–20] that are related to outcome. The objective of this study was to characterize the incidence, patient characteristics, epidemiology, microbiology, and outcome of patients with NSTIs at 6 university-affiliated hospitals in Texas. The hypothesis of the study was that the epidemiology and microbiology of NSTIs affect outcome in patients with NSTIs.

Methods

We conducted a multicenter retrospective chart review of patients diagnosed with an NSTI between January 1, 2004 and December 31, 2007. Six hospitals associated with 4 medical schools participated in the study: Lyndon Baines Johnson General Hospital (LBJGH) and Memorial Hermann Hospital (MHH), affiliated with University of Texas Health Science Center at Houston; the Methodist Hospital (TMH) affiliated with Weill Cornell Medical College; Ben Taub General Hospital (BTGH) and the Michael E. DeBakey Veteran's Affairs Medical Center (VAMC), affiliated with Baylor College of Medicine; and University Hospital (UH) affiliated with University of Texas Health Science Center at San Antonio. LBJGH and BTGH are safety net hospitals in Harris County, Texas that share a common administration; UH is a safety net hospital in San Antonio. MHH and BTGH are the 2 designated Level I Trauma Centers in Houston, and LBJGH is a level III trauma center. MHH and TMH are nonprofit hospitals in Houston. The study was approved by the institutional review boards of all hospitals and universities.

Patients with NSTIs were identified using the *International Classification of Disease, Version 9* (ICD-9) discharge code for necrotizing fasciitis (728.86). Charts were reviewed to verify a diagnosis of NSTI based on documentation in the operative report. Data collected included demographics, risk factors, initial presentation, laboratory values, operative findings, microbiologic results, postoperative care, hospital course, morbidity, and mortality. The Acute Physiology, Age, and Chronic Health Evaluation II (Apache II) scores were calculated using patient admission data when available. Missing data, such as the Glasgow Coma Score and admission inspired oxygen concentration, were assumed to be normal for the Apache II calculations unless otherwise documented.

Demographic and initial presentation data were compared between the patients at the 6 hospitals using analysis of variance for parametric and the Kruskal-Wallis test for nonparametric continuous variables and chi-square analysis for categoric variables using SPSS version 17.0 (SPSS, Inc, Chicago, IL). Univariate and multiple logistic regression analyses were performed to identify predictors of mortality. Because of the large number of independent variables, a P value of less than .01 on univariate analysis was required for inclusion in the initial multiple regression analysis; stepwise regression was performed to achieve the final model. The Wald and partial deviance tests ($P \leq .05$) were used to assess for the contribution of those variables to the overall analysis. The goodness-of-fit of the final multiple regression model was assessed using the Hosmer-Lemeshow test.

Results

Patient characteristics

A total of 296 patients had documented NSTIs: 68 at LBJGH (23%), 67 at BTGH (23%), 60 at TMH (20%), 58 at MHH (20%), 34 at UH (11%), and 9 at VAMC (3%). There was no significant trend in incidence over the 4-year period. The median age was 50 years (interquartile range [IQR] 40–58). There was a significant difference in the ethnic distribution of patients at each hospital (Table 1); the 3 county hospitals (LBJGH, BTGH, and UH) had primarily Hispanic patients, whereas the nonprofit hospitals and the Veteran's Hospital had primarily white patients ($P < .001$). There was a significant difference in the distribution of comorbidities between the hospitals. In particular, TMH, which is a nonprofit hospital, had more patients with cardiac and chronic kidney disease. The nonprofit hospitals, TMH and MHH, had the highest percentage of patients transferred from other hospitals when compared with all other hospitals combined (39% vs 2%, $P < .001$).

Admission physiological and laboratory values

There were several statistically significant differences between centers in a number of admission values, but there was no consistent trend between hospitals. The median Apache II score was 13 (n = 74), and the scores were not significantly different between hospitals. Other markers of disease severity such as systolic blood pressure, lactate level, base deficit, and bacteremia on admission were not significantly different between centers.

Disease characteristics

There were also significant differences in epidemiology and microbiology between hospitals. In half of the cases, no etiologic cause of the NSTI was identified. Trauma was the primary cause of NSTI in 38 cases (13%), with a greater number of cases being attributed to trauma at the 2 level I trauma centers (BTGH and MHH). Injection was the primary cause of infection at UH in San Antonio (9/34%, 26%) but accounted for a small number of cases in Houston (3/264%, 1%). UH also had the highest proportion of patients with monomicrobial methicillin-resistant *Staphylo-*