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Increasing incidence of necrotizing fasciitis in New Zealand: A nationwide study over the period 1990 to 2006

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Summary *Objectives:* Because of concerns following necrotizing fasciitis (NF) reports in the media, we aimed to describe the incidence, mortality, case fatality and distribution of NF in New Zealand (NZ).
Methods: By using International Classification of Disease codes to identify NF cases we analyzed the national hospital discharge and mortality data and reviewed 299 charts from 8 hospitals. The sensitivity and positive predictive value (PPV) of the hospital discharge data were calculated by comparing with the mortality dataset and chart review finding respectively.
Results: Between 1990 and 2006 there was a highly significant rise in annual incidence and mortality rates of NF from 0.18 to 1.69 and from 0 to 0.3 per 100,000 person-years respectively. The causes of this increase are unknown, and were not related to 2004 coding changes for NF. Hospital discharge data had a PPV of 82.6% and sensitivity of 76.8%. The case fatality was 20.8%. Disease risk was highest in the elderly, males, and Pacific and Maori populations.
Conclusions: These findings suggest that incidence and mortality of NF are increasing in NZ. Further work is needed to investigate the causes of this increase and the marked ethnic inequalities in disease rates, particularly factors that may be preventable.

Introduction

Necrotizing fasciitis (NF) is a rapidly progressive soft tissue infection characterized by necrosis of the subcutaneous tissue and fascia. Although rare, NF frequently produces severe illness resulting in death or permanent disability. It may be caused by a variety of aerobic and facultative anaerobic bacteria. Frequently the disease is polymicrobial. One important and common organism causing it is Group A Streptococcus (GAS).[1] Internationally, the

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epidemiology of NF has mostly been documented as a part of invasive GAS infection.[2–4] Starting from the late 1980s, there was an increasing incidence of invasive GAS infections in Europe, including a rise in streptococcal NF.[3,5] In the 1990s and early 2000s, North America observed a more or less static rate.[6] Internationally the reported incidence rate of invasive GAS infection has been around 3 per 100,000 person-years.[4–6] In New Zealand (NZ), although there are published case reports[7] and case series,[8,9] the epidemiology of NF has not been fully described. Though NF has been described by several different terms, in the 1990s it was sensationalized by the popular media as caused by 'flesh eating bacteria.' In the context of a global rise in invasive GAS infection, a suspected increase in NF, and local media reports of severe cellulitis and NF following traditional Samoan tattooing,[10] we documented the epidemiology of NF in NZ. We describe here the incidence over time and person distribution of NF based on analysis of national hospital discharge data and mortality data for the period 1990—2006, and a selected chart review of NF cases for the period 2000—06.

Materials and methods

Hospitalization data

We analyzed NZ Ministry of Health (MoH) maintained hospital discharge data for the period 1990—2006. Hospitalizations are coded with International Classification of Diseases — Australian Modification (ICD-AM) codes. The codes used for NF changed (on 1st July of the year of change) over this period: ICD 9 in use from 1990 to 1999 used "Necrotizing fasciitis" (72886) and "Fasciitis, unspecified" (7294); ICD 10 AM 1st and 2nd editions in use from 1999 to 2004 used "Fasciitis, Not Elsewhere Classified" (M7250-M7259); ICD 10 AM 3rd edition from 2004 onwards used "Necrotizing fasciitis" (M7260-M7269). We included cases with a principal or additional diagnosis of NF. Each discharge record included a unique patient identifier (encrypted master National Health Index (NHI) number) allowing transfers and readmissions with the same diagnosis code to be removed. NF is a rare disease and repeat episodes are practically unheard of.[11] Consequently, only the first admissions were counted to provide a measure of incident disease (i.e., readmissions, presumably for further treatment, were excluded). For counting deaths in the hospital discharge data we counted all cases of NF where the condition at discharge was recorded as 'death'. These hospitalization data included patient age, gender, prioritized ethnicity, District Health Board (DHB), and date of admission.

Mortality data

We analyzed MoH maintained national mortality data for the period 1990 to 2006. These data are based on death certificate information from the registers maintained by Births, Deaths and Marriages (Department of Internal Affairs) and supplemented by information from the coroner and other sources. Each of these records is assigned an underlying cause of death using the ICD-AM codes as used for hospital discharge data. These records also contain the NHI and similar demographic information to hospitalization data. We used this dataset to calculate the sensitivity of hospital discharge data. This calculation assumed that all mortality data cases with cause of death recorded as NF were true cases. We used the NHI to see which of these cases had been admitted to hospital with a diagnosis of NF preceding their death.

Chart review

To assess the validity of coding (positive predictive value) and the impact of coding changes on the diagnosis of NF, we reviewed 299 charts of patients admitted with 'NF' or 'Fasciitis, Not Elsewhere Classified' codes in eight hospitals in the North Island of NZ in the period 2000—06. A case was considered a 'true' case of NF if it satisfied the following criteria:

- Discharge diagnosis of NF (M7250 — M7269 in ICD 10), irrespective of whether NF was the principal diagnosis or an additional diagnosis; AND
- Operation notes clearly indicated presence of necrosis in the fascia and subcutaneous tissue; OR
- Histopathology of debrided fascial and subcutaneous tissue or autopsy findings of local tissue showed necrosis.

Suggestive clinical features (acute cellulitis, severe pain, high leucocytosis or leucopenia, tachycardia, shock), microbiological findings (positive culture of one or more pathogens known to cause NF) and local radiological findings (gas or oedema of the soft tissue) in X-Ray, CT or MRI (if available) were noted and considered in fulfilling the case definition. If the case has been coded as 'NF' or as 'Fasciitis, Not Elsewhere Classified,' but the study criteria were not satisfied, the chart was not reviewed further. We calculated the proportion of cases correctly coded or, in other words, the positive predictive value (PPV) of coding.

Data analysis

Annual NF incidence rates were calculated using number of hospitalized NF cases as numerator and mid-year population estimates from Statistics NZ as the denominator. The incidence rates were adjusted by the sensitivity of hospital discharge data and PPV of coding. Sensitivity was calculated by dividing NF cases documented as 'died' in the hospital discharge dataset who were also documented in the mortality dataset by total number of deaths in the mortality dataset. PPV of coding was calculated by dividing the number of chart-reviewed cases fulfilling the case definition by the total number of charts reviewed.

Mortality rates were calculated using the number of deaths in hospital due to NF as the numerator and estimated mid-year population from Statistics NZ as denominator. Like incidence rates, mortality rates were adjusted using the estimated sensitivity of hospital discharge data. We again used results of the chart review to calculate the PPV for NF cases recorded as dying in hospital. We applied this proportion to the whole study