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Skin infections of the limbs of Polynesian children

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Abstract

Aim The aim of this study was to obtain information regarding the incidence of cellulitis or cutaneous abscess in children of Polynesian ethnicity (including New Zealand Maori), and to calculate the relative risk increase versus other ethnicities.

Methods We reviewed all patients aged between 1 to 14 years who were admitted at our tertiary care institution during the year 2000. Ninety-one children (of 10 different ethnicities) with skin infections were identified.

Results The most common diagnosis was cutaneous abscess (46 of 91 cases, 50.5%), followed by cellulitis (45 of 91 cases, 49.5%). The most common location of infection was the lower limb (79.1%). The major pathogenic organisms were *Staphylococcus aureus* and *Streptococcus pyogenes*. All but one of the children had an uneventful recovery. The incidence of infection in the Polynesian children was 137.7 per 100,000, and the incidence in European children (and children of other ethnic groups) was 35.4 per 100,000. In addition, we calculated a relative risk increase of 3.89 (95% confidence interval of 2.33 to 6.52, $p < 0.05$), which underlines the increased risk that Polynesian children suffer from skin infection.

Conclusion This is the first study showing (in detail) how Polynesian children are affected by a high incidence and increased relative risk of skin infections in their limbs (arms and legs). However, further research (to identify whether genetic disposition or social and environmental circumstances are involved) is required.

Soft tissue infections, and particularly infections of the skin, are a well-known problem in the South Pacific area.[7] Polynesian children are prone to bacterial infections, but little is known about the epidemiology of cellulitis and cutaneous abscess of the limbs in this high-risk population.[1] Cellulitis is a diffuse spreading infection of the skin involving deeper tissues than erysipelas [3]—and characterised by pain, erythema, swelling, and heat. Severe forms of skin infections can be limb- or even life threatening.[9] Infection may start from superficial lesions of the skin providing a portal of entry, but in some patients the cause remains unidentified. The most common causative pathogens are *Staphylococcus aureus* and group A streptococci.[2,4,9]

Common complications of soft-tissue infections are bacteraemia, lymphangitis, local abscess formation (or superinfection) with Gram-negative or gas-forming organisms, necrotising fasciitis, myonecrosis, and osteomyelitis[2,3,11]

The objective of this retrospective audit was to calculate the incidence and the relative risk of skin infections among Polynesian children versus children of European origin.

Methods

In this study, all children aged from 1 to 14 years, and with a soft-tissue infection requiring inpatient treatment at Middlemore Hospital in the period between 1 January.2000 and 31 December.2000 were included—and reviewed using the Plato® computerised audit system.

The following data was recorded for each patient involved: age, gender, ethnic group, and duration of hospital stay. The following diagnoses (listed in International Classification of Diagnoses [ICD]10) were used for selection: cellulitis of face (L03.2), cellulitis of lower limb (L03.10), cellulitis of toe (L03.0), cellulitis of upper limb (L03.10), cutaneous abscess (L02.0-L02.9), and local infection of skin (L08.8).

Fever (>37.5°C), white blood cell count (WBC), serial erythrocyte sedimentation rate (ESRs), and C-reactive protein (CRP) were recorded from all patients. In addition, diagnostic specimens for laboratory evaluation included swab samples from wounds and aspirates. Tissue specimens were Gram-stained.

The method of treatment was noted either as conservative or surgical. The surgical procedure included incision and drainage with washout. Demographic and epidemiological data of the population under the care of our institution were obtained from the Health Profile of Counties Manukau, Auckland.[12]

For statistical evaluation, current software was used to calculate baseline data (SAS 8.02, SAS Institute Inc., Cary, NC, USA). The relative risk interval has been calculated using the Mantel and Haenszel-Method, with asymptotic 95% confidence interval.

Results

Ninety-one cases of skin infection in 91 children were recorded. The most common diagnosis was cutaneous abscess, and the most common site of infection was the lower limb (Table 1). Fifty-three of 91 cases (58.2%) were diagnosed with swab-samples or abscess aspirates.

Table 1. Demographic data and diagnoses of 91 children with skin infection

Age	7.6 years (mean); range, 1 to 14 years
Gender:	
Males	64 (70.3%)
Females	27 (29.7 %)
	Ratio of males/females = 2.37
Hospital stay	3.4 days (mean); range, 1 to 20 days
Diagnosis:	
Cutaneous abscess	46 (50.5%)
Cellulitis	45 (49.5%)
Localisation:	
Upper limb	**19 (20.9%)**
- cutaneous abscess	8 (8.8%)
- cellulitis	11 (12.1%)
Lower limb	**72 (79.1%)**
- cutaneous abscess	38 (41.8%)
- cellulitis	34 (37.3%)

The most common causative pathogen was *Staphylococcus aureus* (33 of 53 cases, 62.2%), followed by *Streptococcus pyogenes* (12 of 53 cases, 22.6%). Methicillin-resistant *Staphylococcus aureus* (MRSA) was identified in 5 cases (9.4%). Gram-negative or sporing organism caused infection in the remaining 3 cases (5.7%). In 38 cases (41.8%), antibiotic therapy was started before admission to hospital, and the diagnosis of soft-tissue infection was made on the basis of clinical evaluation and laboratory investigation. Fever on admission was noted in 16 of 91 patients (17, 58%)

and there were 75 of 91 cases (82, 4%) with an abnormal white blood cell (WBC) count (mean value 13, 31 x 10^9 cells/L). Fifty of 91 cases (54, 9%) had a raised serial erythrocyte sedimentation rate (ESR) with a mean value of 28 mm in 1 hour.

Only 25 of 91 patients (27,5%) were tested using C-reactive protein (CRP)—with the mean value being 52 mg/L (range: 5 to 123 mg/L). Forty-eight of 91 cases (52, 7%) underwent surgical treatment (incision and drainage) followed by antibiotic therapy. In 43 cases (47, 3%), conservative therapy was employed using antibiotics. The infection resolved uneventfully in 90 children. Osteomyelitis (requiring surgical treatment and prolonged antibiotic therapy) occurred in 1 case (1.1%).

During the observation period, Middlemore Hospital was responsible for the healthcare of a total of 103,900 children.[12] The ratio of Polynesian children to New Zealand European children was 1.04. During the study period, 8251 children required inpatient treatment. 2096 of 4885 Polynesian children (42.3%) were of New Zealand Maori ethnicity. The ratio of Polynesian children to New Zealand European children was 1.45.

Comparison of ethnical group distribution is depicted in Table 2. There was a statistically significant higher number of Polynesian children suffering from cellulitis and skin abscess (73 of 91 children, $p < 0.05$). Thirty-eight (41.8%) of these 73 children were of New Zealand Maori ethnicity. The estimated incidence of skin infection in the Polynesian population was 137.7 per 100,000 (73 out of 53,000). In contrast, the estimated incidence of infection in European children was 35.4 per 100,000 (18 out of 50,900).

Table 2. Admissions according to ethnicity of children living in the urban and suburban area served by Middlemore Hospital

Ethnicity	Population served by Middlemore Hospital	Admissions (for any reason)	Admissions (for skin infections)
Polynesian	53.000 (51%)	4885 (59.2%)	73 (80.2%)*
European	50,900 (49%)	3366 (40.8%)	18 (19.8%)
Total	**103,900**	**8251**	**91**

*The difference is statistically significant ($p < 0.05$).

The calculated relative risk (referring to the total population of children under the healthcare of the hospital) was 3.89 (95% confidence interval of 2.33 to 6.52, $p < 0.05$). The calculated relative risk (referring to the total number of children requiring in-patient treatment) was 2.79 (95% confidence interval of 1.67 to 4.67, $p < 0.05$).

Discussion

The aim of this study was to obtain data regarding the incidence of skin infections in Polynesian children (including New Zealand Maori), and to calculate the relative risk increase versus children of other ethnicities.

Hill et al[6,7] have shown that people from Pacific Island countries frequently suffer from bacteraemia caused by *Staphylococcus aureus*, and consequently are at a higher risk of developing bone and joint infections. Moreover, children of Polynesian ethnicity (including New Zealand Maori) show a higher incidence of meningitis and

pneumonia—the reasons remain unclear, but it has been hypothesised that the high infection rate could be attributed to genetic disposition. Social circumstances are also likely to be involved.[1]

In the present study, the incidence of skin infection of the limb in the Polynesian children was rated 137.7 per 100,000. In contrast, the incidence in European children was rated 35.4 per 100,000. We calculated that the relative risk of acquiring skin infections in Polynesian children was 3.89 times greater than European children. This value refers to the whole population of children under the healthcare of a tertiary hospital. The calculated relative risk increase (referring to the number of all children requiring inpatient treatment) was 2.79. The discrepancy of the values (3.89 versus 2.79) is related to the higher ratio of Polynesian children versus New Zealand European children requiring inpatient treatment (ratio = 1.45:1), when compared to the ratio of the whole population of children under the healthcare of the hospital (ratio=1.04:1).

Two different scenarios could explain this discrepancy: i) the general health condition of Polynesian children is poorer than that of European-ethnicity children, and consequently they require more inpatient treatment, and ii) some children of European ethnicity are also treated in other hospitals. In our opinion, the reality is probably a combination of both scenarios. From the statistical point of view, both calculated relative risk values in this study are correct (with respect to the data they are generated from)—ie, children with cutaneous infection versus all children requiring inpatient treatment, or versus total children population under healthcare in one hospital. Nevertheless, data regarding children ethnicity under hospital care are estimated. In contrast, data of inpatient children ethnicity are accurate.

Cutaneous abscess was the most frequent soft-tissue infection (64%). Specifically, the lower limb appeared to be the most common site of infection, which is supported by findings of other authors.[3-9] It can be assumed that the skin of lower limbs is more often injured during daily life, especially the foot and knee area, thereby providing portals of entry. In our patients, the most frequent pathogens were *Staphylococcus aureus* and *Streptococcus pyogenes*; this finding is also supported by other authors.[4,9]

The low rates of infection caused by Gram-negative bacteria can be explained by the young age of the population studied.[8] Cellulitis is expected to occur more often in association with systemic diseases like diabetes or other immunodeficiencies.[4] Surprisingly, only one child on steroid medication was found in our patient population.

This is the first study showing (in detail) the increased relative risk of skin infections that Polynesian children experience (versus children of other ethnicities). However, the present study has some major disadvantages. Firstly, this is a retrospective audit regarding a single-hospital experience. Secondly, the observation period was too short to pull together all potential complications following the skin infection, particularly regarding bone and joint involvement. Thirdly, diagnosis of infection has been given without microbiology testing in 42% of children.

In conclusion, this study shows that there is a marked difference in incidence and relative risk between Polynesian and European children in how they suffer from skin infections. Further research is required to identify whether genetic disposition or social and environmental circumstances are involved in this phenomenon.[13]

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