Enhanced surveillance for meningococcal disease in Queensland in 1999

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Abstract

Enhanced surveillance of invasive meningococcal disease commenced in Queensland in 1999. There were 93 cases, an incidence of 2.8/100,000 population. Most (87%) cases were laboratory confirmed, but 12 per cent were probable cases without laboratory confirmation. The highest age-specific attack rates were in the under 1, 1 to 4 and 15 to 24 year age groups. Most of the serologically characterised isolates were group B (70%), followed by group C (24%). There were 12 deaths, resulting in a case fatality rate of 13 per cent. Those who died were more likely to have group C than group B disease (OR 5.04, CI 1.05-25.14). Only 14 per cent of cases that saw a general practitioner (GP) prior to hospitalisation received parenteral antibiotics, 23 per cent of the 35 cases referred to hospital by a GP received pre-hospital parenteral antibiotics and 33 per cent of cases were notified to health authorities within 24 hours of hospital admission. Thirty per cent were notified two or more days after hospitalisation, delaying the start of public health action. Enhanced surveillance has demonstrated a need to promote the use of pre-hospital parenteral antibiotics by GPs and a need to encourage more timely reporting of cases to health authorities. *Commun Dis Intell* 2000;24:332-336.

Keywords: Neisseria meningitidis*, diagnosis, meningococcus, invasive, enhanced surveillance, indigenous, parenteral antibiotics*

Introduction

Before 1999, only laboratory-confirmed cases of invasive meningococcal disease (IMD)* were routinely notified in Queensland. Because the probable clinical cases (with no laboratory confirmation) were not notified, an under-ascertainment of the true incidence of IMD resulted. Furthermore, important information (such as the indigenous status, the clinical and public health management, and the clinical outcome of each patient) was not routinely collected.

From the beginning of 1999, public health physicians implemented 'enhanced' surveillance of IMD in Queensland, which not only included probable clinical cases, but also extra details on each case. In this report we describe (i) the epidemiology of IMD in Queensland in 1999, (ii) the relevant details of the clinical and public health management of the cases, and (iii) the completeness of the information collected through the enhanced surveillance.

Methods

A standard surveillance report form for IMD, based upon that used in New Zealand[1] was developed for use by Public Health Units (PHUs) throughout Queensland. A case of IMD was defined as:-

- Confirmed, if there was a clinically compatible illness and at least one of: (i) isolation of *Neisseria meningitidis* from a normally sterile site, or (ii) detection of gram-negative diplococci in a specimen from a normally sterile site, or (iii) a positive meningococcal antigen test on cerebro-spinal fluid (CSF) or (iv) detection of meningococcal DNA in a specimen from a normally sterile site.
- Probable, if there was a clinically compatible illness and at least one of: (i) a petechial or purpuric rash, or (ii) isolation of *N. meningitidis* from a throat swab,[2] (iii) an epidemiological link to a confirmed case.

'Disease onset' for the calculation of timeliness of hospitalisation refers to this episode of illness, and includes the spectrum of disease from those who were mildly unwell initially to those with classic meningococcal disease.

Where possible the PHUs obtained the information detailed on the report form from the patient, the immediate contacts or the clinicians. Data from completed forms forwarded to the Communicable Disease Unit (CDU), Queensland Health, Brisbane, were entered on a computerised database.

Pathology laboratories throughout Queensland refer meningococcal isolates to Queensland Health Scientific Services (QHSS), Brisbane, for confirmation of the serogrouping and for further phenotypic characterisation. These laboratory data were also sent to the CDU for entry on its database.

The database was analysed using Epi Info version 6.04b and Windows Excel 97. Data from the 1996 national census were used to calculate incidence rates.

Results

Epidemiology and clusters

In all there were 93 cases of IMD in Queensland in 1999, an incidence of 2.8/100,000 population. The median age was 16.3 years (range 0.2 to 84.4 years) and the male:female

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ratio was 1:1.1. The highest number of cases occurred in the under 1 and 1 to 4 years age groups (11.8% and 22.6% of cases respectively). There was a secondary peak in the 15 to 19 years age group that extended into the 20 to 24 years age group (Figure 1).

A typical winter peak was exhibited in 1999 with 48.4 per cent of cases occurring between May and August. There was no clustering by town or suburb in 1999. Indigenous status was recorded in 81 (87%) of cases. Six of these cases (7.4%) were indigenous, all children under 15 years of age (four cases were under 5 years).

There were two recognised clusters in 1999. The first in May 1999 was of serogroup B disease among three people. Two had been passengers in the same train on the same date and the third case was a contact of one of the travellers. There was no known direct contact between the two train passengers but one was sitting behind the other for approximately 24 hours. The first two were co-primary cases; the third became ill 11 days after the primary cases. Analysis of the DNA of isolates using pulsed field gel electrophoresis (PFGE) confirmed that these cases were linked.

The second cluster in July 1999 was two cases of serogroup C disease, also confirmed by PFGE. The second case had illness onset 3 days after the first case and was a contact of a contact of the first case.

Laboratory diagnosis

Of the 93 cases, 81 (87%) were confirmed, 11 (12%) were probable and one could not be categorised due to missing data. Of the confirmed cases, 67 were culture-positive; 4 were confirmed by PCR alone, 6 by detection of gram-negative diplococci in blood or CSF alone and 4 by a combination of PCR, antigen detection or organism detection. All 11 probable cases were diagnosed by a clinically compatible illness in association with a rash.

All 67 isolates were serogrouped; 47 (70%) were group B, 16 (24%) were group C and there were 2 each of group Y and W135. Of the 11 isolates from fatal cases, 6 were group C and 5 were group B.

Forty (63.5%) of the 63 group B and C isolates could be further serotyped. No strain predominated among the group C isolates. The most commonly isolated strains among the group B isolates were 4:P1.4 (7) (n=5) and 15:P1.7 (n=5).

Serogroup B infections outnumbered serogroup C infections in all age groups, with the ratio being highest in the under one-year age group (Figure 2).

Clinical features, clinical management and outcomes

Twenty-one of the 93 cases (22.6%) were recorded as having both meningitis and septicaemia, 19 cases (20.4%) presented with septicaemia alone, 20 (21.5%) with meningitis alone and 2 (2.2%) with septic arthritis alone. A petechial or purpuric rash occurred in 57 (61%) of presentations. All 12 cases that died presented with septicaemia and 5 of these also had a meningitic component.

The 12 deaths from IMD represented a case fatality of 13 per cent, with the highest proportion of case fatalities in the 20 to 29 years (29%) and 1 to 4 years (19%) age groups. The median age of those dying was 19 years, compared with 14.9 years for those surviving.

Figure 1. Number of meningococcal cases, Queensland, 1999, by age group and sex

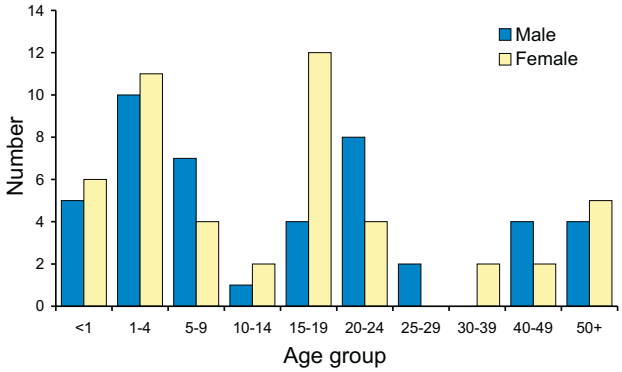
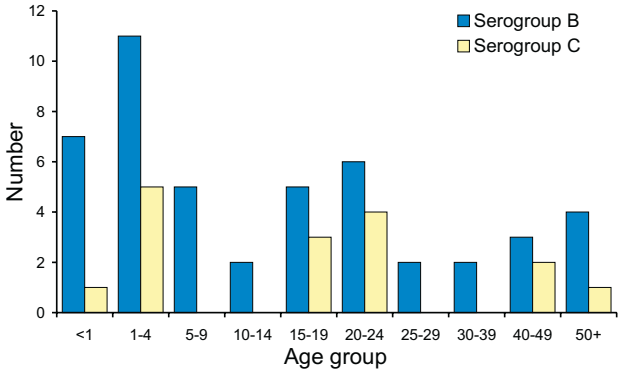


Figure 2. Number of meningococcal cases, Queensland, 1999, by age group and serogroup



Those with serogroup C disease were more likely to die than those with serogroup B disease (OR 5.04, 95% CI 1.05-25.14, p = 0.02) and those with a rash were more likely to die than those without (OR 5.96, 95% CI 0.7-133.2, p = 0.09). Those who saw a general practitioner (GP) prior to hospitalisation were less likely to die than those who did not (OR 0.24, 95% CI 0.05 -1.01, p = 0.05).

Information on which cases saw a GP prior to hospitalisation was available in 89 cases; 56 (63%) saw a doctor, of these 8 (14%) were recorded as having received parenteral antibiotics. Information on which cases were referred to hospital by a GP was available in 86 cases; of these, 35 (41%) were referred to a hospital. If only those cases referred to hospital by the GP (ie. those in whom the GP probably suspected meningococcal disease) are used as the denominator, the percentage of cases receiving pre-hospital parenteral antibiotics increased to 23 per cent (8/35).

Meningococci were isolated from 2 (25%) of the 8 cases who received pre-hospital parenteral antibiotics (p = 0.05) and from 55 (67%) of the 82 cases who did not.

Table 1. Days from general practitioner visit and meningococcal disease onset to hospitalisation, and from hospitalisation to notification, Queensland 1999

	Days									
Time interval	<1	1	2	3	4	5	6	7	NR*	Total cases
From GP visit to hospital admission	36	12	5	0	1	0	0	0	2	56
From disease onset to hospital admission	23	35	14	5	2	2	2	2	8	93
From hospitalisation to notification (probable)	31(3)	27(5)	15(1)	5	1	3(1)	0	1	10(1)	93(11)

* Not recorded

Of the 56 cases who saw a GP prior to hospital admission, 36 (64%) were admitted within 24 hours of being seen (Table 1) while 18 (32%) took one day or more to be hospitalised. Of the 12 who died, 4 had been seen by a GP prior to hospitalisation, and of these 3 were referred to hospital; one had been treated pre-admission with parenteral antibiotics.

Fifty-eight (62%) of the cases were hospitalised in less than 48 hours from disease onset (Table 1). The median number of days between disease onset and hospitalisation was one day for both those who survived and those who died.

Eleven of 78 cases (14.1%) had a throat swab taken at the time of the first dose of antibiotics and 67 of 85 cases (78.8%) had blood cultures taken. Eighteen cases had neither blood cultures nor throat swabs taken before antibiotic administration.

Public health management

Information on time taken for notification was available in 83 (89%) of cases; in 25 (30%) of these it took two or more days for the local PHU to be notified of the hospitalisation (Table 1). In all but one of 40 cases for whom there was enough information to calculate response time this was one hour or less.

In most episodes, household contacts were the main type of contact (n = 77), followed by contact with oral secretions (n = 34), other close contacts (n = 26), institutional (n = 9) and childcare (n = 5) contacts. On average, 11.7 contacts per case were eligible for chemoprophylaxis; none was offered vaccine in 1999.

Table 2 lists the percentages of missing data by section (excluding the section on laboratory details for which data are obtained from reference laboratories). In general, fields that related to time (eg. time of initial response, time of onset, time seen by GP, time hospitalised) had the highest percentage of missing data. Indigenous status is an important field for which there were 12 entries missing.

Table 2. Mean percentages of data missing from surveillance report forms, by section

Section	Mean missing data (%)	Range (%)
Notifier details	21.4	2.2 - 45.2
Patient details	13.1	0 - 72.0
Clinical presentation	15.1	7.5 - 23.7
Status (confirmed/probable)	9.7	
Clinical course	13.1	0 - 46.2
Case management	13.2	0 - 16.1
Risk factors	10.4	0 - 50.0
Outbreak details (Yes/No)	11.8	

Discussion

At 2.8/100,000, the incidence of IMD in Queensland in 1999 was similar to that in Australia in 1998 (2.4/100,000).[3] This contrasts with the considerably greater incidence in England and Wales (5/100,000 in 1998), and New Zealand (13.9/100,000 in 1999).[4] The latter extremely high incidence reflects the sustained epidemic of serosubtype B:4:P1.4 disease in New Zealand.[4] This strain is also present in Queensland, although the numbers are small and have remained similar since 1996.[5]

The incidence of IMD by age group and season was typical of that generally described in developed countries. Most cases were sporadic, with only two confirmed clusters. At 7.4 per cent, the proportion of meningococcal disease among those identified as indigenous was high compared with the proportion of indigenous people in the general population (2.8%). Monitoring of IMD trends in the indigenous population needs to continue.

The diagnosis of meningococcal disease was confirmed in most cases by isolation of the organism from blood or CSF. The proportion of positive cultures was reduced in those who had received pre-hospital antibiotics. With the continued emphasis on the importance of pre-hospital antibiotics, and the increasing reluctance of clinicians to undertake lumbar puncture, non-culture diagnostic tests (in particular PCR) will increasingly be required to confirm a diagnosis of IMD. In addition to confirming the presence of meningococcal DNA, PCR testing has the capability to determine serogroups, serotypes and serosubtypes from clinical specimens.[6]

The hallmark of meningococcal septicaemia is a haemorrhagic rash that does not blanch under pressure.[7] Modelled on initiatives in England and New Zealand, for the first time in 1999 all GPs and emergency department physicians in Queensland were sent pictorial information depicting the typical rash of meningococcal disease. A rash was present in 57(66%) of cases, and all 12 patients dying

had septicaemia. GPs were urged to administer parenteral penicillin to anyone displaying the symptoms and signs of meningococcal septicaemia. Despite this, only 23 per cent of the cases referred to a hospital by a GP received pre-hospital parenteral antibiotics. The questionnaire did not record whether the GP suspected IMD, a question now included in the latest version.

Recent experience in New Zealand has documented a significantly lower case fatality in patients given antibiotics prior to hospitalisation.[4] Numbers reported here were too small to show this. Although other determinants of disease outcome, such as the severity at initial presentation, could influence the association between pre-hospital antibiotic use and case fatality, the early administration of antibiotics is generally considered the most important means to prevent IMD deaths. Further initiatives are needed to get GPs to administer parenteral penicillin to possible IMD cases, and monitoring of the proportion given pre-hospital antibiotics should continue.

Seventy per cent of isolates in Queensland in 1999 were serogroup B, not dissimilar to the proportion reported nationally in 1998 and 1999 (63%).[3,8] Queensland differed from Victoria and New South Wales in 1999 in that group C disease did not predominate in the 15-44 age group.[8] Although the small number of cases meant that the confidence intervals were wide, the group C case fatality rate (CFR) was significantly higher than that for group B disease. National data for 1999 were similar (CFR in group C disease was 14.9 per cent compared with 6.4 per cent in serogroup B disease).[8] As an effective vaccine against this serogroup is available, these deaths are potentially preventable and decisions about whether or not to introduce routine vaccination need to be reviewed continually.[9]

Because the risk of secondary cases is much greater in the days immediately following the onset of the index cases than later on, immediate notification of suspect cases of IMD to PHUs is crucial so that contacts can be identified, counselled and offered chemoprophylaxis if indicated.[10] That only 33 per cent were notified within 24 hours of hospital admission, and 30 per cent notified two or more days after hospitalisation, is thus of considerable concern. Late reporting may indicate some clinicians await laboratory confirmation before notification. Further efforts to get clinicians to notify cases upon clinical suspicion are required.

Public health physicians agreed unanimously that IMD be the first disease for enhanced surveillance in Queensland. Therefore the amount of missing information is both surprising and disappointing. Some fields, such as 'indigenous status' and 'outcome' were considered important enough to justify enhanced surveillance. High proportions of missing data in some fields (Table 2) may reflect a need to clarify the form, but PHUs should attempt to ensure that the enhanced surveillance report forms are completed with reliable detail. Further monitoring of the completeness of information collected by PHUs is necessary.

In conclusion, the first year of enhanced surveillance in Queensland has already demonstrated the need to improve (i) GP awareness of the diagnosis of IMD, and the effectiveness of parenteral administration of antibiotics prior to the urgent referral to hospital, (ii) the timeliness of notification of IMD by clinicians, and (iii) the completeness of the information collected by PHUs on each case of IMD. Extra costs beyond those normally involved in collecting data for case management were minimal and mainly related to data entry and analysis.

Continued enhanced surveillance will enable detection of trends. However these may need to be interpreted with caution, given that increasing identification of cases by non-culture based methods means that increasing numbers of milder cases are likely to be uncovered.[8] Data pooled over several years will allow more meaningful analysis of risk factors and management practices, as would adoption of enhanced surveillance nationally.

*** Abbreviations:**

CDU, Communicable Disease Unit; CFR, case fatality rate; CSF, cerebrospinal fluid; GP, general practitioner; IMD, invasive meningococcal disease; PCR, polymerase chain reaction; PHU, Public Health Unit; PFGE, pulsed field gel electrophoresis; QHSS, Queensland Health Scientific Services.

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