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Meningococcal disease in South Australia: incidence and serogroup distribution 1971–1980

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SUMMARY

During the ten-year period 1971–80 isolates of meningococci from 85 cases of meningococcal disease (MD) in South Australia, from 66 children, 6 adolescents and 13 adults, were examined. These comprised 69 cases of meningitis and 16 cases of bacteraemia without meningitis. Thirty-three (39%) of all cases of MD occurred in children less than 1 year of age, the median age was 19 months. Serogroup B accounted for 61 (72%) cases of MD, group A seven (8%), group C seven (8%), group W135 five (6%), group Y three (4%) and group X one (1%); in addition there was a single case of *Neisseria lactamica* infection.

The annual prevalence of MD in South Australia for the period was 11 cases per 100000 for children under the age of 2 years and 0·7 cases per 100000 overall. The prevalence was highest in winter (45% cases) and spring (26%) and lowest in summer (13%). The overall mortality rate was 8%. Four of the 21 infants under the age of 6 months died (mortality rate 19%) whereas none of the 32 children aged from 6 months to 14 years died ($P = 0{\cdot}02$). Amongst the survivors, three children had deafness, which was bilateral and severe in two.

INTRODUCTION

There are important regional differences in the epidemiology of meningococcal disease (MD) and in the serogroup distribution of meningococci. Thus, in western Europe and in North America (Anonymous, 1974, 1978) most infections are endemic and are caused by *Neisseria meningitidis* group B, whereas in the 'meningitis belt' of Africa there are periodic epidemics caused by group A (Greenwood *et al.* 1979). In South America an extensive outbreak was caused by group C, only recently recognized as capable of causing epidemic disease (de Morais *et al.* 1974). During the past decade successful field trials have shown the efficacy of group A and C vaccine in preventing MD (Artenstein *et al.* 1970; Peltola *et al.* 1977). Because effective meningococcal vaccines are now avilable and because little is known of the prevalence of MD in Australia, we studied the prevalence of MD in South Australia and the serogroup distribution of isolates over a 10-year period.

MATERIALS AND METHODS

For the ten-year period 1971–80 we studied isolates of *Neisseria meningitidis* (meningococci) from all patients with MD at the Adelaide Children's Hospital (ACH). We also examined meningococci which were sent to us from other hospital laboratories within South Australia. We believe that isolates from most cases of MD in South Australia during the period were tested. For inclusion in the study, the patient suffered from meningococcal bacteraemia or meningitis, or both, and an isolate was available from either blood or cerebrospinal fluid, or both. The study comprised 85 cases of meningococcal disease: of these 78 (92%) occurred in Adelaide, the remainder were in Mount Gambier (three cases), Whyalla (two cases), Berri and Port Lincoln. Of the 85 cases, 59 (69%) were treated at ACH. Four patients were aborigines, the remainder were caucasians. South Australia had a population of about 1·2 million in 1976, of whom about 0·85 million (70%) lived in Adelaide. Most endemic cases of MD occur in children less than 2 years of age; the mean number of children under 2 years of age in South Australia was 40165 in the period 1971–80.

Meningococci were identified by standard biochemical tests, including the oxidase reaction and fermentation tests for glucose, maltose and sucrose. Isolates were tested serologically by slide agglutination using diagnostic meningococcal sera from the Commonwealth Serum Laboratories (when still available) and from Burroughs Wellcome. Isolates were also sent to a reference laboratory (see Acknowledgements).

RESULTS

Of the 85 cases of MD, 66 (78%) occurred in children (< 14 years), six (7%) in adolescents (14–20 years) and 13 (15%) in adults (> 20 years). Most of the children in the study (57/66, 86%) were treated at the Adelaide Children's Hospital (ACH). As we may not have received isolates of meningococci from all patients who were admitted to other centres, the age distribution of cases (Fig. 1) is given separately for ACH cases and for the other cases. No cases occurred in the neonatal period; the youngest patient was 4 weeks and the oldest was 82. The median age of all cases was 19 months and for cases treated at ACH was 12 months. The prevalence of MD was highest in the first 12 months of life and 33 (30%) cases occurred in this age group. After the age of 13 months there was a decline in prevalence (Fig. 1).

At all ages except adolescence, MD was commoner among males (Table 1). However, the differences observed were not significant. The mean number of cases per year was eight with the highest in 1971 and 1972 (11 cases each) and the lowest in 1980 (four cases). There was a definite seasonal fluctuation with the highest prevalence in winter (45% cases) and spring (26%) and the lowest in summer (13%). In all age groups meningitis was the major clinical manifestation (Table 1). Sixteen (18%) patients had bacteraemia without meningitis. Two children had arthritis, which involved the wrist and hip joints, respectively. There were seven fatal cases (Table 2a). The overall mortality rate was 8% and amongst children was 6%. On follow-up three children had deafness, which was bilateral and severe in two (Table 2b).

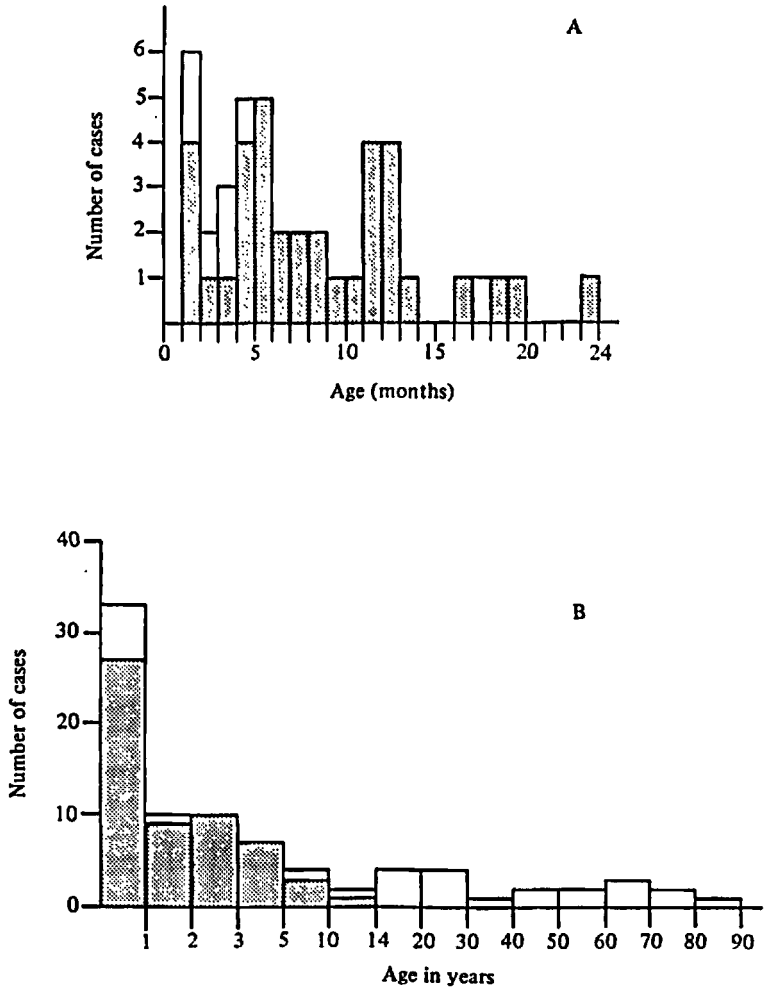

Fig. 1. Meningococcal disease in South Australia, 1971–80. (A) Cases in children 0–24 months; (B) all cases. Shaded bars indicate patients presenting to Adelaide Children's Hospital.

Table 1. *Meningococcal disease in South Australia*, 1971–80 *clinical categories*

Age group	Children (< 14)		Adolescents (14–20)		Adults (⩾ 21)		Totals
Category*	f	m	f	m	f	m	
Bacteraemia	5	5	2	0	1	3	16
Meningitis	25	31	1	3	3	6	69
	30	36	3	3	4	9	
Totals	66		6		13		85

* Seven patients had clinical and/or bacteriological evidence of both bacteraemia and meningitis, these are included in the category of meningitis.

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Table 2(*a*). *Fatal cases of meningococcal disease in South Australia*, 1971–80

Case	Year	Age (years)	Sex	Diagnosis	Serogroup
1	1971	3 months	f	Meningitis	C
2	1972	5 months	m	Bacteraemia	B
3	1973	59	m	Bacteraemia	B
4	1974	20	m	Meningitis	Y
5	1976	5 months	m	Meningitis	B
6	1978	2 months	f	Meningitis	B
7	1979	48	m	Meningitis	W 135

Table 2(*b*). *Sequelae in children with meningococcol disease in South Australia*, 1971–80

Case	Year	Age	Sex	Serogroup	Sequelae
8	1974	3 years	f	A	Severe bilateral deafness
9	1978	7 weeks	m	B	Mild deafness, left ear
10	1979	5 weeks	m	B	(1) Hydrocephalus, shunt inserted (2) Severe (bilateral) deafness

Table 3. *Meningococcal disease in South Australia*, 1971–80: *serogroup distribution*

	Age (years)					Total	
Serogroup	< 1	1–4	5–13	14–20	⩾ 21	*n*	(%)
A	2	3	0	0	2	7	8·24
B	25	21	5	2	8	61	71·76
C	3	2	0	2	0	7	8·24
W 135	2	0	0	1	2	5	5·88
X	1	0	0	0	0	1	1·18
Y	0	1	0	1	1	3	3·53
N. lactamica	0	0	1	0	0	1	1·18
Total	33	27	6	6	13	85	100·00

Serogroup B predominated with 61 (72%) of 85 isolates (Table 3). Of the other 25 strains, one was *Neisseria lactamica* (Hansman, 1978), which is closely related antigenically to *Neisseria meningitidis* group B, and the remainder belonged to groups A, C, W135, X and Y; meningococci of groups D, Z or 29e were not encountered.

DISCUSSION

Previous studies have shown that MD has its highest prevalence in children, especially in young children (Compton, 1918; Feldman, 1972). This was borne out in the present study where the overall median age was 19 months and for children

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(< 14 years) was 11 months. From our data, the annual prevalence rates in South Australia have been calculated as 10·7 cases per 100000 for children under the age of 2 years and 0·7 cases per 100000 overall. These rates are similar to those encountered in the United States (Anonymous, 1979). In South Australia the prevalence of meningococcal meningitis in children is lower than that of haemophilus meningitis. Thus in the years 1979 and 1980 three children were treated at ACH for meningococcal meningitis, 46 for haemophilus meningitis (and four for pneumococcal meningitis). As far as we are aware, all cases in the present study were endemic. The mortality rate was highest amongst infants: there were four deaths amongst 21 children under 6 months of age (mortality rate 19%) whereas none of the 32 children aged from 6 months to 14 years died. This difference is significant by the Fisher two-tailed exact test ($P = 0{\cdot}02$). The overall mortality rate (8%) was similar to that encountered recently in Scandanavia (Peltola *et al.* 1982).

Of the six meningococcal serogroups met with, group B was predominant. Although true epidemic infection caused by group B has been reported only rarely, strains of this serogroup may produce intra-family outbreaks, however, these were not recognized in the present study. After group B, groups A and C were next in prevalence, followed by group W 135. Group W 135 was not encountered until 1979 when it caused four cases of MD followed by a single case in 1980. Meningococci of serogroup W 135 may be highly virulent as shown by two of the 1979 cases. One was fatal (Table 2a), another almost so. The latter occurred in a 21-year-old man who had undergone splenectomy 3 months earlier because of an abdominal injury but was otherwise healthy: he suddenly became desperately ill and developed severe hypotension, renal failure, respiratory failure and disseminated intravascular coagulation, which required prolonged management in an intensive care unit; eventually there was a good recovery.

Early attempts to confer immunity to the meningoccus by active immunization, using vaccines which were prepared from whole bacterial cells killed by heat, proved unsuccessful. Initially, failure also occurred with vaccines prepared from purified extracts of capsular polysaccharides. Gotschlich and his colleagues (1969) then showed that for a vaccine to be effective it must elicit the formation of bactericidal antibody, and that in order to achieve this it was necessary to employ capsular polysaccharides of high molecular weight. When volunteers were immunized with a group A polysaccharide vaccine so prepared, bactericidal antibody was produced. Although young children had a relatively poor antibody response, group A vaccine was shown to be successful in reducing the prevalence of MD in children as well as in adults (Peltola *et al.* 1977). Group C polysaccharide vaccine has also been used successfully, for example in a controlled trial in service recruits in the United States (Artenstein *et al.* 1970). Although a successful group B vaccine has not been developed so far, probably because of the poor antibody response to group B antigens, work in this field continues.

What is the place of meningococcal vaccine in Australia? Despite the proven efficacy of meningococcal vaccine of group A and of group C, the low prevalence of MD caused by these serotypes in South Australia does not justify widespread vaccination at the present. However, this situation may change and it is desirable for accurate information regarding the prevalence of MD to be collected on a

national basis. Canada has shown a lead in this respect, with its national meningococcus reference centre in Ottawa. If an effective and safe meningococcus group B vaccine is produced, vaccination could be considered for those communities at relatively high risk.

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