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# *Short reports*

## Acute bacterial meningitis in childhood: aspects of prehospital care in 687 cases

Before the introduction of specific therapy most children with bacterial meningitis died. Although intensive antibiotic treatment in hospital has dramatically improved the prognosis for such children the fatality rate is still usually 10–15% and it seems not to have improved in recent years (Haggerty and Ziai, 1964; Smith *et al.*, 1973). I therefore reviewed some features of prehospital management of children with bacterial meningitis.

### Patients and method

Several different record sources were used to try to identify all cases of acute bacterial meningitis, meningococcal infection, and acute meningitis of presumed bacterial aetiology (sterile pyogenic meningitis which had been treated in hospital as bacterial) occurring between 1969 and 1973 in children under 10 years of age in the North-west Metropolitan Region (north-west London and adjacent counties). Relevant data were then abstracted from the case notes. The method and diagnostic criteria used in the study are described in detail elsewhere (Goldacre, 1976). Neonatal cases which developed before discharge of the newborn infant from hospital are excluded from this report.

### Results

Among 687 cases identified, including 72 deaths, the fatality rate was 10·5%. 10 children died outside hospital and another 6 were certified dead on arrival. These accounted for 22% of all deaths. The source of hospital admission was recorded for 616 of the remaining 671 patients: 478 were general practitioner (GP) referrals (78%), 114 were admitted direct from casualty departments (18%), 12 as a result of a consultant domiciliary visit, 7 from a health visitor's call, and 5 from outpatient departments. A letter was available for 445 of the 478 GP referrals. A diagnosis of meningitis or encephalitis was considered in the letter for 2 of the 8 neonatal cases, 77 of 141 postneonatal cases (55%), 140 of 215 children aged 1–4 years (65%), and 60 out of 80 children aged 5–9 years (75%). The rising proportion with age confirms the difficulty there may be in diagnosing intracranial infection in infants and young children.

Out of all the patients 47% were known to have received antimicrobial chemotherapy before hospital admission, 26% were recorded as having received no such therapy, and no statement was made for 27% (Table 1). An organism was cultured from 68% of patients treated before admission, 93% of those not treated, and 79% of those about whom no statement was made. The fatality rates in these three groups were 4·8%, 11·6%, and 9·9% respectively. A few cases of sterile, pyogenic meningitis may have been early viral rather than bacterial meningitis. Nevertheless, when cases with no organism isolated are excluded from Table 1 the fatality rate remains lower in the pretreated than the untreated group. Chemotherapy was usually given before a diagnosis of meningitis was considered. The drugs used are probably representative of antimicrobials prescribed by general practitioners for less serious illness in this age group. The appreciable use of tetracycline for infants and young children is noted.

A significantly larger number of patients with an adverse outcome (death or permanent neurological sequelae) were admitted on a Monday than on any other day of the week (Table 2).

### Discussion

The true proportion of pretreated children is probably higher than 47% because some for whom no statement was made may have received prior treatment. A similarly high proportion of pretreated cases has been reported in two studies from the United States (Jarvis and Saxena, 1972; Converse *et al.*, 1973). These studies suggested that 'inadvertent pretreatment' does not 'hamper the diagnosis or prejudice the outcome nearly so much as one might expect' (*Lancet*, 1974), although the total number of deaths in each study (four and six respectively) was small. The present study supports these views with two reservations about outcome. Firstly, patients in the pretreated and untreated groups may have differed in the nature and severity of presenting symptoms. Secondly, the analysis does not include patients

Table 1 *Treatment with antibacterial chemotherapy before cerebrospinal fluid examination in 668 cases*

| *Treatment* | *Total no.* (%) | *No.* (%) *positive bacterial culture* | *No.* (%) *deaths** |
|---|---|---|---|
| Penicillin | 136 (20·4) | 95 (69·9) | 6 (4·4) |
| Ampicillin | 74 (11·1) | 43 (58·1) | 1 (1·4) |
| Tetracycline | 32 (4·8) | 24 (75·0) | 2 (6·3) |
| Erythromycin | 29 (4·3) | 23 (79·3) | 2 (6·9) |
| Other antibiotic | 44 (6·6) | 30 (68·2) | 4 (9·1) |
| All treated cases | 315 (47·2) | 215 (68·3) | 15 (4·8)† |
| Untreated cases | 172 (25·7) | 160 (93·0) | 20 (11·6)† |
| Unspecified | 181 (27·1) | 143 (79·0) | 18 (9·9) |
| Total | 668 (100) | 518 (77·5) | 53 (7·9) |

*Excludes 16 patients who died outside or on arrival at hospital and 3 fatal cases for whom full case notes were not available.
†$\chi^2$ for number of deaths = 6·86, P <0·01.

Table 2 *Day of week of admission to hospital (number of patients)*

| | *Saturday* | *Sunday* | *Monday* | *Tuesday* | *Wednesday* | *Thursday* | *Friday* | *Total* |
|---|---|---|---|---|---|---|---|---|
| All cases | 83 | 86 | 112 | 104 | 95 | 96 | 95 | 671* |
| Deaths | 6 | 6 | 13 | 11 | 9 | 4 | 7 | 56† |
| Permanent sequelae | 8 | 4 | 14 | 12 | 7 | 9 | 8 | 62† |
| Died outside/dead on arrival at hospital | 2 | 2 | 2 | 2 | 5 | 1 | 2 | 16 |

*$\chi^2$ (6) = 6·16, NS.
†$\chi^2$ (6) for adverse outcome (deaths and permanent sequelae on each day of the week) = 12·75, P <0·05.

who died outside hospital, for whom comparable information was unavailable.

If delays occur in admitting patients to hospital at weekends (DHSS, 1970) an excess of deaths outside hospital at weekends might be expected. That this was not found indicates, within the limits of the small numbers available, that moribund children are no less likely to be admitted to hospital at weekends than on other days. However, significantly more children with an eventual adverse outcome (death or permanent sequelae) were admitted to hospital on a Monday than on any other day of the week. Follow-up records may be incomplete and the figures in Table 2 probably underestimate the incidence of permanent sequelae, but it is unlikely that the recording of sequelae at follow-up would be biased by the day of the week on which the patient was admitted. Possibly delay over the weekend occurs in some cases. This and the fact that 22% of all deaths occurred before hospital admission indicate that any improvements in hospital care alone could avert only a proportion of present-day deaths from bacterial meningitis.

## Summary

Some basic features of the prehospital management of children with acute bacterial meningitis were ascertained by a retrospective review of case notes. A diagnosis of intracranial infection was considered in 63% of general practitioners' referral letters and was more often considered for older than younger children. 47% of children had received antibacterial chemotherapy before hospital admission. Such treatment did not appear to have jeopardized the outcome. The possibility of delay in the admission of children to hospital at weekends is discussed.

I thank the clinical consultants, directors of diagnostic microbiology laboratories, medical officers of health, and medical records officers throughout the North-west Metropolitan Region for their kind co-operation.

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# Neonatal vaccination with 'universal strength' BCG vaccine

In April 1975, the intradermal BCG vaccine used in the UK was changed to 'universal strength', which is approximately twice the strength of the old. This report concerns the first results with 'universal strength' BCG in newborn infants in the UK and will later report the tuberculin response over a one-year period. Useful information on the acceptability of the vaccine has already been obtained.

## Method

Consent was sought from mothers of children born in the Fazakerley Hospital, Liverpool, to have their infant vaccinated with BCG, and vaccination generally took place within the first few days of life. 0·05 ml universal strength BCG vaccine ($12{\cdot}4\times10^6$ viable units/ml) was given by intradermal injection with syringe and needle into the upper arm. The infants were seen again at 2 months when the BCG vaccination lesion was examined and measured. A Mantoux test using 5 tuberculin units (Tu) of PPD-S (0·0001 mg PPD-S, CDC, Atlanta, Ga., USA) was performed. This tuberculin test will be repeated 1 year after vaccination.

## Results

Of 219 children vaccinated, 159 had their BCG lesions measured. The Fig. shows the distribution of lesion diameters, the mean diameter being 5·2 mm 2 months after vaccination. As shown in the Table, about a third of the lesions discharged, lasting only 2 to 3 days in most. In 2 infants deep ulcers developed which healed without treatment in 2 and 3 days. The Table also shows that 15 of the 146 infants Mantoux-tested had tuberculin reaction diameters $<5$ mm, giving a conversion rate (Mantoux reaction $\geqslant 5$ mm diameter induration) of 90·3%.

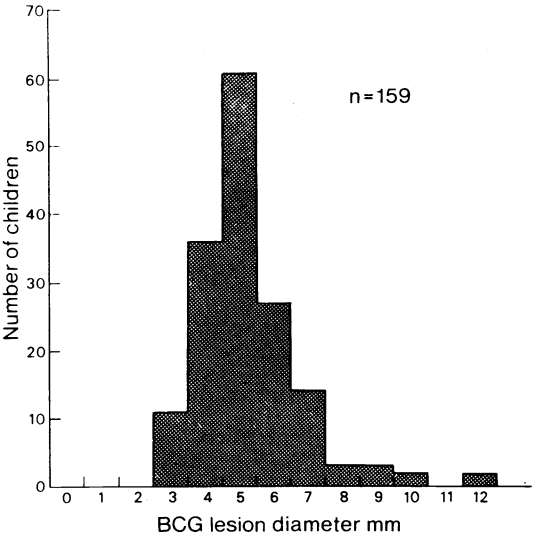


Fig. *BCG lesions in 159 neonates.*

Table *Details of BCG vaccination and Mantoux test*

| | |
|---|---|
| Total no. vaccinated | 219 |
| No. BCG lesions examined | 159 |
| Mean diameter of BCG lesion | 5·2 mm |
| No. of BCG lesions with discharge | 52 |
| Mean no. of days with discharge | 2–3 |
| No. with ulcers | 2 |
| No. Mantoux tested | 146 |
| No. with lesions <5 mm induration | 15 |
| Conversion rate ⩾(5 mm diameter) | 90·3% |

## Discussion

The results indicate that the universal strength BCG vaccine was well tolerated by newborn infants. The mean BCG lesion diameter was fairly small and together with the low incidence of ulcers indicates a very acceptable response to the vaccine. This confirmed previous findings in schoolchildren using BCG of similar strength (Brindle *et al.*, 1972).

Although 15 infants appeared to be tuberculin negative 2 months after vaccination, this may be due to the low dose of PPD used. Previous work (Griffiths and Gaisford, 1956) suggests that a larger dose of PPD is required to elicit a tuberculin response in infants than in adolescent children. A dose of 100 Tu of Weybridge PPD has been used in infants with success, but 5 Tu was chosen to avoid severe reactions which might have occurred. A conversion rate of over 90% is still considered to be a satisfactory 'take'.