

## Quality Improvement Report

# Managing meningitis in children: audit of notifications, rifampicin chemoprophylaxis, and audiological referrals

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### Abstract

**Important aspects of the management of meningitis in children include notification to local officers for control of communicable diseases; chemoprophylaxis for index cases and close contacts in cases of meningococcal or *Haemophilus influenzae* meningitis; and a formal hearing assessment for all survivors. A retrospective audit of these aspects of management was carried out for children admitted with meningitis in 12 months from 1 September 1990 to 31 August 1991 at the Royal Belfast Hospital for Sick Children. Only 20 of 36(56%) cases were notified by medical staff. Chemoprophylaxis was arranged for all close family contacts but to only five of the 23(22%) index cases for whom it was indicated. Appointments for audiological testing were arranged for only 19 of the 32(59%) survivors. Subsequently all doctors, including each intake of junior doctors, were given written information on the importance of notification and locally agreed guidelines for chemoprophylaxis and hearing assessments for survivors before discharge. Guidelines were also displayed prominently in each ward. A repeat audit from January 1992 to December 1992 showed significant improvement in these aspects of care. Twenty eight of 32 cases (88%) were notified, chemoprophylaxis was given to 20 of 22(91%) index cases for whom it was indicated, and 25 of 29(86%) survivors had hearing assessments arranged before discharge. Correct management of some aspects of care cannot be assumed, even if statutory (notification), nationally agreed (chemoprophylaxis), or generally agreed good practice (hearing assessments). These aspects of care improved after the first audit but the authors conclude that the notification rate remains below 100% and a repeat audit is necessary.**

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### Introduction

Correct management of children with meningitis includes early diagnosis, identification of the causal organism and prompt treatment with

appropriate antibiotics. All cases of meningitis (viral or bacterial) should be notified by the attending doctor as soon as possible, and preferably within 48 hours of diagnosis, to local officers for communicable disease control to facilitate control of infection and to identify close contacts who will need chemoprophylaxis and for epidemiological surveillance.<sup>1</sup> Siblings, other family members, and close contacts of the index case may be at increased risk of infection if the meningitis is caused by *Neisseria meningitidis* (meningococcal meningitis) and *Haemophilus influenzae*.<sup>2</sup> Nationally agreed guidelines advise which patients and families need to be offered chemoprophylaxis (for example, rifampicin) to eliminate nasopharyngeal carriage of the organism and thus reduce the risk of close contacts acquiring the disease.<sup>2-3</sup> Immediate family contacts, who are often at most risk, can usually be prescribed rifampicin chemoprophylaxis by the attending doctor shortly after meningitis has been diagnosed in the index case.

Children who recover from meningitis (viral or bacterial) may have a residual partial or unilateral hearing deficit. The deficit may be minor and go unnoticed but cause difficulties in acquiring speech and language. Therefore all children who recover from meningitis should have a formal hearing assessment, carried out by trained staff with methods appropriate to the child's age under ideal circumstances.<sup>4-8</sup> Traditionally this assessment has been performed 4 to 6 weeks after discharge, allowing time for any associated middle ear infection to have resolved. A recent survey suggested that most paediatricians in the United Kingdom are aware of the need for such children to have formal hearing assessments but information is not available on how often these are done.<sup>9</sup>

This hospital admits patients directly from a busy casualty department and receives tertiary referrals of seriously ill children from district general hospitals in Northern Ireland to the medical wards and to the paediatric intensive care unit; it looks after many children with meningitis. When a case of meningococcal or *H influenzae* meningitis is diagnosed the attending doctors routinely arrange for the immediate family to receive chemoprophylaxis (if appropriate) and leave the local officers for communicable disease control to determine which other close contacts require chemoprophylaxis.

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We were concerned to know whether our practice met the required standards for notification of cases of meningitis, for chemoprophylaxis, and for the assessment of hearing using formal hearing assessments in those children admitted with meningitis.

### Patients and methods

#### DESIGN

We carried out two audits of the care of children with meningitis as part of one audit cycle at the Royal Belfast Hospital for Sick Children. These audits focused on specific aspects of management: the frequency of notification; the use of chemoprophylaxis for immediate family contacts and index cases; and the frequency of hearing assessments. Both audit periods were for 12 months and the data were collected retrospectively during the subsequent month and then presented to medical staff several months later. The first audit examined the care of children with meningitis admitted between 1 September 1990 to 31 August 1991, and the results were fed back to the relevant staff two months later, in October 1991. The second audit studied those children with meningitis admitted between 1 January 1992 and December 1992.

The box shows the expected standards of care.

#### Expected standards of care

- (1) All cases of meningitis should be notified by the attending doctor to local officers for communicable disease control within 48 hours of diagnosis
- (2) Rifampicin chemoprophylaxis should be given early to:
  - (i) immediate family contacts and close contacts of patients with meningococcal disease
  - (ii) All children with meningococcal meningitis (index cases) should also receive rifampicin as, although penicillin treats meningitis effectively, it does not eradicate the organism from the nasopharynx
  - (iii) in cases of *H influenzae* meningitis associated with other children aged under 5 years living in the same home all household contacts and index case should be given a course of rifampicin
- (3) All children who recover should have a hearing assessment

It has been our practice for hospital medical staff to prescribe chemoprophylaxis to the immediate close family contacts and to allow the local officers for communicable disease control to determine which other close contacts should be offered chemoprophylaxis.

#### PATIENTS

Children aged up to 14 years with a diagnosis of acute viral or bacterial meningitis and receiving treatment at this hospital in the two 12 study month periods were the focus of the study.

We included children with abnormalities of the cerebrospinal fluid suggesting acute infective meningitis (for example, increased white blood

count) and children with signs of meningitis and positive results in blood culture, but who had not had a lumbar puncture because it was considered unsafe or unnecessary (for example, owing to raised intracranial pressure or presence of a meningococcal rash and signs of meningism). Children with infective complications secondary to ventriculoperitoneal shunts or other surgical conditions were excluded.

We identified patients from the following sources: the hospital records system, laboratory results of cerebrospinal fluid testing, daily statements of diagnoses from the medical wards, and from stubs of official notification books.

#### DATA COLLECTION

For each case the following information was collected retrospectively by PB and MDS. The names of those cases notified and the date of notification were obtained from the records of the local officers for communicable disease control and from each ward's notification book. The time to notification was calculated as the number of days elapsing from confirmation of diagnosis to the date the local officers for communicable disease control first received telephone or written notification.

Index cases with immediate close family contacts who required urgent chemoprophylaxis were identified and those for whom this had been arranged by the attending doctor were identified from the case notes and prescriptions given to family members. The ward drug records were used to determine which index cases had been given chemoprophylaxis. Children referred for hearing assessment were identified from the case notes and those who had been tested were identified from audiology records in the case notes and cross checked with the computerised database in the audiology department.

#### DATA ANALYSIS

Comparisons were made with  $\chi^2$  tests to test for significant changes between the two study periods in notification rates, time taken to notification, rifampicin chemoprophylaxis, and hearing assessments.

### Results

Table 1 summarises the distribution of the infecting organism for the 68 cases of meningitis treated during the two 12 month audit periods.

#### FIRST AUDIT

Table 2 shows the results for the first and repeat audits. Thirty nine children were identified as having acute bacterial or viral meningitis from September 1990 to August 1991. Three children whose notes were untraceable were excluded. Four of the remaining 36 children died.

#### Notifications

Twenty of 36 cases (56%) were notified, 11 (31%) within 48 hours of the child's admission to hospital, five on days 3 or 4, and four later than day 4.

**Table 1** Infecting organisms in 68 cases of meningitis treated during two 12 month audit periods. Figures are numbers of children

	Total	First audit (Sep 1990-Aug 1991)	Repeat audit (Jan 1992-Dec 1992)
<i>Haemophilus influenzae</i>	27(2†)	18(1†)	9(1†)
<i>Neisseria meningitidis</i>	24(4†)	8(2†)	16(2†)
<i>Streptococcus:</i>			
<i>S. pneumoniae</i>	2	1	1
<i>S. pyogenes</i> Group B	1		1
<i>S. pyogenes</i> Group D	1(1†)	1(1†)	
Unknown (bacterial)	7	4	3
Viral	6	4	2
Total	68(7†)	36(4†)	32(3†)

†Deaths.

**Rifampicin chemoprophylaxis**

Rifampicin chemoprophylaxis should have been offered to the immediate family contacts of 26 index cases. In all of these cases the immediate family contacts were offered chemoprophylaxis by the attending physician.

Rifampicin prophylaxis was indicated for each of 23 children who recovered from meningococcal or *H influenzae* meningitis but was given to only five (22%).

**Hearing assessment**

There was a record in the casenotes of all 32 children who recovered from meningitis that an outpatient appointment for hearing assessment should be arranged four to six weeks after discharge. But requests were received by the audiology department for only 19(59%), and only 16(50%) attended. Fourteen of the children had normal hearing on testing, one child who had had pneumococcal meningitis had a sensorineural hearing deficit, and one child was known to be deaf before the episode of meningitis.

**Feedback of audit results**

These results were presented and discussed at the monthly hospital audit meeting attended by the junior and senior medical staff and senior ward nursing staff two months later. The following recommendations and actions were agreed.

- (1) To reduce delay in notifying cases notifications to the local officers for communicable disease control should be made

**Table 2** Notifications, rifampicin prophylaxis, and hearing assessments in index cases of meningitis during first and repeat audits. Figures are numbers (percentages) of children

	First audit (Sep 1990-Aug 1991)	Repeat audit (Jan 1992-Dec 1992)
No of children	36	32
Time to notification (days):		
≤2	11(31)	11(34)
3 or 4	5(14)	9(28)
>4	4(11)	8(25)
Total*	20(56)	28(88)
Rifampicin prophylaxis given to index case†:		
Yes	5/23(22)	20/22(91)
No	16/23(69)	2/22(9)
Total**	21/23(91)	22/22(100)
Hearing assessment performed on surviving index cases:		
Yes	16‡/32(50)	25/29(86)
No	13/32(41)	4/29(100)
Total***	29/32(91)	29/29(100)

Yates's corrected  $\chi^2$  test between audits \* $p < 0.01$ , \*\* $p < 0.001$ , \*\*\* $p < 0.04$ .

†Prophylaxis indicated for 23 children in first audit, 22 children in repeat audit.

‡Requests for hearing assessment received by audiology department for 19 children.

by telephone on suspicion of meningitis. An easy access telephone number was made available on each ward. Oral notification should be confirmed by written notification.

- (2) Copies of guidelines for rifampicin chemoprophylaxis for the index case and for family contacts were displayed prominently on each ward noticeboard and also given to all medical staff and senior ward nursing staff.
- (3) To increase the number of survivors having a hearing assessment all children who have recovered from meningitis should have a hearing assessment performed by the audiology department as soon as they have recovered sufficiently and before discharge from hospital. Only those children found to have a hearing deficit would have a follow up outpatient appointment in the audiology department.

This information was circulated in writing to all doctors and senior ward nursing staff working in the hospital. Each new intake of junior doctors was given an oral summary of the audit findings and this written information on their first introduction to the hospital.

**REPEAT AUDIT**

Thirty two children were identified as having acute bacterial or viral meningitis in the 12 months from January to December 1992. Three children died.

**Notifications**

Twenty eight of the 32 cases (88%) were notified, 11(34%) within the first 48 hours, nine on days 3 or 4, and eight after 4 days. Yates' corrected  $\chi^2$  test showed a significant improvement in the numbers notified ( $p < 0.01$ ), but tests for trend did not suggest a significant improvement in the time delay for notification.

**Rifampicin chemoprophylaxis**

Rifampicin chemoprophylaxis to immediate family contacts was indicated for 25 of the index cases and was offered for 23(92%). Twenty of the 22 children (91%) who recovered and for whom prophylaxis was indicated received chemoprophylaxis (table 2). Yates' corrected  $\chi^2$  test shows a significant improvement ( $p < 0.001$ ) in the rate of prophylaxis during the second period.

**Hearing assessment**

Twenty five of the 29(86%) survivors had a hearing assessment carried out before discharge (table 2). Yates' corrected  $\chi^2$  test shows that there was a significant improvement ( $p < 0.04$ ) during the second period. Nineteen children were reported to have normal hearing and six had evidence of middle ear disease and were subsequently followed up at audiology outpatient units. No child had evidence of a sensorineural hearing impairment.

**Discussion**

This audit identified deficiencies in some important aspects of management of children

with meningitis. Failure to notify cases denies the opportunity to trace vulnerable contacts of the index case – for example, school or nursery contacts – and of offering rifampicin chemoprophylaxis. Local officers for disease control are responsible for this but unless notified of each case cannot fulfil this function. Failure to notify – in this case almost half the cases treated during the first year's audit – will significantly distort epidemiological information.

By highlighting the deficiencies through audit and making changes the notification rate increased in the repeat audit period, although the standard of 100% notification has yet to be reached and there remains an unacceptable delay before many cases are notified. Attending doctors in the ward, because they prescribe rifampicin chemoprophylaxis to immediate family contacts and index cases, may feel that notification is no longer urgent. However, local officers for communicable disease control are responsible for ensuring that other close contacts (at nursery or school) receive chemoprophylaxis so this notification delay needs to be rectified.

In the first audit there was clearly an awareness of the need to give rifampicin chemoprophylaxis to immediate family contacts but not of the need to do so for index cases. This information was given to the medical staff and by the second audit index case chemoprophylaxis was achieved for most index cases.

We thought that children were routinely referred to the audiology department for hearing assessment after recovery from meningitis, and the medical notes indicated that for most children this was a stated intention. By

changing the process of referral and asking the audiology department to see and test all survivors of meningitis before discharge we have ensured that most of the children now receive a hearing assessment.

Sustaining and improving on the changes prompted by this audit will be important. Junior medical staff stay on the firm for only a few months; therefore important messages about many aspects of care need to be reiterated for each change of junior staff. The recommendations from this audit are now incorporated into the locally produced *Paediatric Prescriber*, which describes recommended treatments for common or serious diseases and is given to all junior doctors who work at the hospital.

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