

Prospective study of "door to needle time" in meningococcal disease

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Abstract

Objectives—To measure the promptness of antibiotic treatment in children with meningococcal disease.

Methods—"Door to needle time" for parenteral antibiotics in children with meningococcal disease was recorded prospectively as part of a larger study. The time from arrival at hospital until the first dose of parenteral antibiotics was recorded in 100 children with meningococcal disease (median (range) age 21 (3-168) months) admitted to four Merseyside hospitals.

Results—Forty five children presented directly to the accident and emergency (A&E) department. Parenteral penicillin was given before admission to 19 of the 55 children referred by general practitioners (GPs). Median door to needle time was 36 minutes. All children with a typical petechial rash on arrival received antibiotics within 60 minutes. Antibiotics were given sooner to those with severe disease ($p=0.01$) and later to those without a rash ($p=0.007$).

Conclusions—The first dose of parenteral antibiotics for most children with meningococcal disease was given in A&E. When awareness of meningococcal disease is heightened by ongoing research, those with a petechial rash are treated within 60 minutes. Strategies to improve immediate treatment of meningococcal disease should include education of A&E staff as well as GPs.

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Meningococcal disease in children can have a sudden onset and may rapidly lead to death.¹ Delays in diagnosis and treatment may contribute to the high mortality from this disease.² The early administration of parenteral antibiotics is recommended.³ Preadmission antibiotics may decrease mortality from meningococcal disease⁴ and are recommended by the chief medical officer.⁵ However only about 30% of patients with meningococcal disease admitted by general practitioners (GPs) are given preadmission parenteral antibiotics.⁴ Information leaflets about meningococcal disease encourage parents to attend an accident and emergency (A&E) department if their GP is not immediately available.⁶ There are few data available on when these A&E attenders first receive parenteral antibiotics.

Studies of the promptness of antibiotic treatment in children with meningitis have found antibiotics are started two to three hours after admission.⁷⁻⁹ These studies are retrospective and contain few children with meningococcal disease. The characteristic rash (which heralds the most severe form of the disease, meningococcal septicaemia) should enable early identification of these children and lead to early antibiotic treatment. However a study from Birmingham suggests antibiotic treatment may be delayed even in those with the characteristic rash.¹⁰

The aim of this study was to measure prospectively the time between arrival at hospital and the first dose of parenteral antibiotics ("door to needle time") in children with meningococcal disease.

Methods

This prospective study was part of a larger multicentre study of meningococcal disease on Merseyside. This included all children admitted to four hospitals with meningococcal disease between September 1992 and April 1994: Alder Hey Children's Hospital, Arrow Park, Whiston, and the Countess of Chester hospitals. The research fellow could get to each hospital within 45 minutes. Each hospital received referrals from GPs and also direct attenders at A&E. The research fellow (FAIR) was called immediately the diagnosis of meningococcal disease was made and attended each case soon afterwards. A clinical assessment was made for each child including presence or absence of a rash and disease severity.

DEFINITIONS

Meningococcal disease was defined as an illness in a child who had *Neisseria meningitidis* isolated from either blood or cerebrospinal fluid, or an illness with fever and petechiae, diagnosed as meningococcal disease by the local paediatrician in a child with no cerebrospinal fluid or blood isolate of *N meningitidis*.¹¹

Severe meningococcal disease was defined as any child with meningococcal disease who scored 8 or more at any time on the Glasgow meningococcal septicaemia prognostic score.¹²

Door to needle time was defined as the time from the recorded time of arrival at hospital until the parenteral administration of appropriate antibiotics. Time of administration of antibiotics was determined from GP referral letters, A&E cards, drug charts, case notes, or directly from the staff involved.

Results

One hundred and twenty six children with meningococcal disease were admitted, 13 of

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Table 1 "Door to needle time" in 81 children with meningococcal disease; data are median (range)

	Door to needle time (min)	p Value*
Rash (n=62)	33 (8-930)	
No rash (n=19)	48 (26-2496)	0.007
GMSPS ≥8 (n=27)	30 (15-483)	
GMSPS <8 (n=54)	45 (8-2496)	0.01
Died (n=6)	32 (15-483)	
Survived (n=75)	40 (8-2496)	0.70
A&E (n=45)	40 (8-2496)	
GP (n=36)	33 (15-1320)	0.26

*Statistical analysis by Mann-Whitney U test.

GMSPS = Glasgow meningococcal septicaemia prognostic score.

whom died. Door to needle time was recorded in 100 children, nine of whom died.

Fifty five children were referred by GPs, of whom 19 (33%) received preadmission parenteral antibiotics. These 19 children were excluded from further analysis leaving data available on 81 children. Their median (range) age was 21 (3-168) months. The 36 children not given preadmission penicillin were referred without a diagnosis or as "meningitis" rather than meningococcal disease.¹³

The median door to needle time was 36 minutes, ranging from 8 minutes to 41.6 hours.

Door to needle time was significantly shorter in those with severe disease and significantly longer in those who had no rash (table 1). There was no significant difference in the door to needle times of those who died compared with survivors or in GP referrals compared with A&E attenders (table 1).

All those with the typical petechial rash of meningococcal septicaemia on arrival received antibiotics within 60 minutes. Antibiotics were delayed in those with the less well recognised maculopapular rash or with no rash.

Discussion

This prospective study of door to needle time in children with meningococcal disease shows that during a multicentre study, those with a typical petechial rash on arrival are given antibiotics within 60 minutes. This occurred irrespective of the mode of referral (GP or self referred). Antibiotics were given sooner to those with the most severe disease, perhaps because they had the most obvious rashes.¹⁴

Those who died did not receive antibiotics significantly later than survivors, but this analysis will be confounded by disease severity and the small number of deaths.

Antibiotics were given later to those with the less well recognised maculopapular rash as described previously.¹³ Those children with no rash (that is those with meningococcal meningitis alone) mostly received antibiotics within two to three hours of arrival, similar to previous studies of meningitis.⁷⁻⁹ This study took place as part of a larger study of meningococcal disease in Merseyside and this may have influenced the results. There is a high incidence of meningococcal disease on Merseyside¹⁵ and local research had increased

awareness. The junior paediatric staff at all the hospitals were regularly taught about meningococcal disease. Nursing staff in the A&E departments and children's wards also received teaching and were aware of the study. The research fellow visited all children with suspected meningococcal disease urgently and ensured antibiotics were given promptly.

Door to needle times in hospitals in areas with a lower incidence of meningococcal disease and not taking part in research into the disease may be longer than those seen in this study (FAI Riordan, unpublished data). Antibiotic treatment was delayed for more than 60 minutes in 10 of 27 (37%) patients with meningococcal disease and a characteristic rash in Birmingham during 1993.¹⁰

This study also shows that in urban areas, like Merseyside, 45% of children with meningococcal disease present directly to A&E departments. Since only 35% of GP referrals were given preadmission penicillin, the first dose of antibiotic for over 80% of children with meningococcal disease was given in hospital, often in an A&E department. The first doctor to see a child with meningococcal disease needs "knowledge out of proportion to their previous experience".³ The knowledge of an experienced A&E nurse may help the junior doctor to give antibiotics promptly.

Antibiotic treatment is only the first step in managing meningococcal disease. Assessment of disease severity and treatment of shock or raised intracranial pressure may also be needed urgently.¹⁶ This study however was not designed to assess the timeliness of these subsequent treatments.

Our study shows that door to needle time can be measured in children with meningococcal disease and that this might be a useful marker for clinical effectiveness. Where there is a high awareness of meningococcal disease among paediatric and A&E staff (both medical and nursing), such as during a period of active research, most children receive antibiotic treatment within one hour of arriving at hospital. Strategies to improve the immediate treatment of this life threatening infection therefore need to be targeted at A&E staff as well as GPs.

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