

# Bacterial aetiology of meningitis in children from Kathmandu, Nepal, 2005–2014

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## INTRODUCTION

Bacterial meningitis is an important cause of mortality and morbidity globally<sup>1</sup> but three of the most important pathogens, *Streptococcus pneumoniae*<sup>2</sup>, *Haemophilus influenzae* type b<sup>3</sup> and *Neisseria meningitidis*<sup>4</sup> are vaccine-preventable. Nepal introduced routine infant vaccination against *H. influenzae* type b (Hib) in 2009, and routine infant pneumococcal conjugate vaccination (PCV10) in 2015. We present data on the bacterial aetiology of meningitis in children admitted to Patan Hospital, Kathmandu, Nepal, for the 10 years preceding the introduction of PCV10.

## METHODS

Invasive bacterial disease (IBD) surveillance (including meningitis surveillance) has been undertaken at Patan Hospital since March 2005.

- All children <14 years of age with suspected IBD had blood sampled and cultured (using BACTEC®).
- All children with suspected meningitis/encephalitis underwent CSF sampling (excepting standard contra-indications), cell count, biochemistry and culture (using standard methods).
- In all years CSF samples were tested for *S. pneumoniae* using the Binax NOW® immunochromatographic test if patient age was ≥1 month and CSF white cell count (WCC) was >5 cells/mm<sup>3</sup>.
- In 2005–2012 CSF was also tested for *S. pneumoniae*, *H. influenzae* and *N. meningitidis* using latex agglutination if patient age was ≥1 month and CSF WCC >5 cells/mm<sup>3</sup>.
- In 2005–2006 and 2008–2014 CSF samples with >5 WCC/mm<sup>3</sup> were tested with PCR analysis for *S. pneumoniae* (*lytA* gene) and *H. influenzae* (*hpd* gene) at Christian Medical College (CMC), Vellore, India.
- In 2005–2006 and July 2009–2012 PCR for *N. meningitidis* (*sodC* gene) was done at CMC. PCR was not done for any other pathogen. See Table 1.

TABLE 1

Sampling and microbiological analyses by year

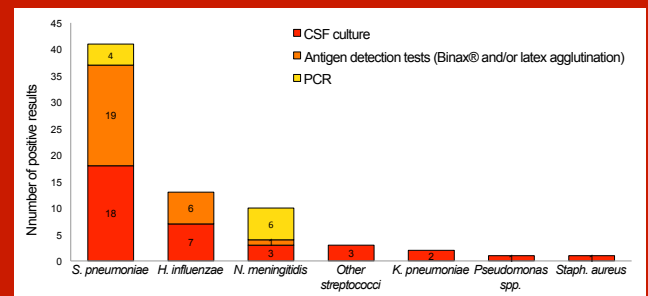
Tests from CSF	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CSF culture	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Binax NOW® <i>S. pneumoniae</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Latex agglutination for <i>S. pneumoniae</i> , <i>N. meningitidis</i> and <i>H. influenzae</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
PCR for <i>S. pneumoniae</i>	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PCR for <i>H. influenzae</i>	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PCR for <i>N. meningitidis</i>	Yes	Yes	No	No	From July	Yes	Yes	Yes	No	No

## RESULTS

- Data were available from 10575 cases of suspected IBD, of whom 1078 (10.2%) were diagnosed with meningitis at discharge/outcome (using clinical features and CSF data), and 1022 (94.8%) had CSF sampling.
- Despite inconsistent testing, 35 (50%) of cases with an identified aetiology had aetiology identified by antigen detection tests or PCR only (Figure 1).
- Figure 2 describes the changing aetiology of meningitis over time.

FIGURE 1

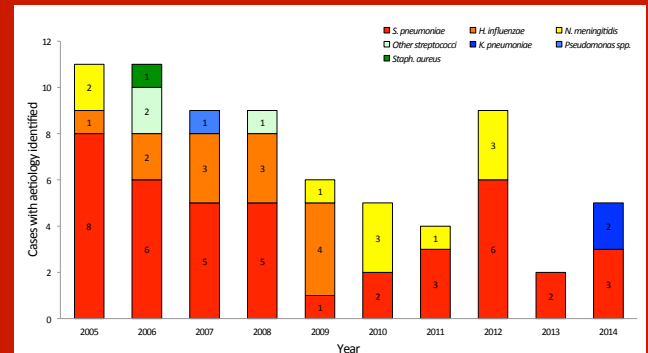
Number of patients with meningitis and CSF sampling with aetiology identified by culture of CSF, antigen detection tests or PCR (n=1022).



Cases shown as identified by antigen detection tests were culture negative; cases shown as identified by PCR were both culture and antigen detection test negative (i.e. all cases count only once).

FIGURE 2

Cases of meningitis with aetiology identified by any method from CSF



## CONCLUSION

- S. pneumoniae* was the most commonly identified pathogen.
- H. influenzae* has not been identified in CSF since 2009, possibly due to introduction of Hib vaccine in 2009.
- Bacterial culture remains important for the detection of pathogens and antibiotic resistance.
- The high proportion of cases with aetiology defined by culture-independent methods highlights their additional importance.
- Given the inconsistency in testing these data are likely to underestimate pathogen-specific burdens of meningitis, in particular for *N. meningitidis* meningitis<sup>5</sup>, for which PCR surveillance should be continued.

## REFERENCES

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