has been previously reported. The same finding was observed in our study.

There was a strong association between maternal diabetes and CHD in our study. Narchi and Kulaylat concluded that DS should be added to congenital malformations already known to occur more frequently in infants of diabetic mothers.

In conclusion, the interaction between trisomy 21 genes and consanguninity and/or environmental factors can increase the risk of several additional birth defects.

References

Recurrent Streptococcus pneumoniae Meningitis

by Farzin Davachi,a Hamide Bregu,b and Gjeorgjina Litoa

a New York Medical College, Valhalla, New York, USA
b Department of Pediatrics, University Hospital Center of Tirana, Tirana, Albania

Introduction

Although meningitis in children continues to be a worldwide cause of morbidity and mortality, recurrent bacterial meningitis remains a rare phenomenon. Patients with head injury are at the highest risk of acquiring recurrent bacterial meningitis, followed by patients with a congenital anatomic lesion of the skull or dura such as meningoencephalocele. The underlying pathology is a transdural communication between the meningeal space and paranasal sinuses or skin. The first attack of meningitis may occur from several weeks to 12 years after head injury. In addition recurrent bacterial meningitis may be due to disorders of the immune system, such as in patients with a complement deficiency.

From 1988 to 1995, five children with recurrent Streptococcus pneumoniae meningitis were admitted to the section of Pediatric Infectious Diseases at the University Hospital Center of Tirana. This is the first series to be reported from Albania.

Patients

Patient 1

This 9-year-old boy was admitted on 10 December 1988 because of fever, headache, vomiting and increasing lethargy of 2 days’ duration. At 8 months of age he was admitted with the diagnosis of S. pneumoniae meningitis and suffered sensoryneural hearing loss.

On this admission, the anterior fontanel was still open and there was a palpable linear sagittal defect in the right parietal bone. CSF culture grew S. pneumoniae. Roentgenograms and CT scan of the skull demonstrated an open anterior fontanel and a linear sagittal defect in the right parietal bone. Although he was treated, the parents refused surgical intervention. Since then he was reported to have had four more episodes of S. pneumoniae meningitis.

Patient 2

This 4-year-old boy was admitted on 5 December 1989 with fever, headache and vomiting of 1 day’s duration. At 4 weeks of age, he was hospitalized with S. pneumoniae meningitis and developed sensoryneural hearing loss and mental retardation.
On this admission, *S. pneumoniae* grew in CSF culture. Roentgenograms and CT scan of the skull revealed deficiency of the terminal complement component (C5).

He was again hospitalized with *S. pneumoniae* meningitis in May 1990, September 1990, and May 1991.

**Patient 3**

This 10-year-old boy was admitted on 2 February 1993 with a history of fever, headache, vomiting, and seizure of 1 day's duration.

In May 1991 the child had fallen from the rooftop of his three-story house while playing. The roentgenograms of the skull reported a linear fracture of the frontal bone. In 1992 he was hospitalized with *S. pneumoniae* meningitis. Roentgenogram of the skull was reported to be normal.

On this admission, CSF culture grew *S. pneumoniae*. Roentgenograms and CT scan of the skull were reported to be normal.

**Patient 4**

This 12-year-old girl was admitted on 10 February 1994 with fever, severe headache, lethargy and vomiting of 6 hours' duration.

In September 1991 the child was hit by a motor vehicle and sustained head trauma. Roentgenograms revealed a basal skull fracture. No rhinorrhea or otorrhea were reported. One month later the child was hospitalized with *S. pneumoniae* meningitis.

On this admission, *S. pneumoniae* grew in CSF culture. Roentgenograms of the skull did not demonstrate a basal skull fracture.

**Patient 5**

This 11-year-old girl was admitted on 13 March 1995 with a history of headache, fever and vomiting of 2 days' duration.

In May 1992 she had fallen off a second story rooftop while playing and was reported to be fine. Three days later, however, she developed *S. pneumoniae* meningitis.

On this admission, CSF culture grew *S. pneumoniae*. Roentgenograms of the skull did not demonstrate any fracture.

**Discussion**

We report three boys and two girls with recurrent *S pneumoniae* meningitis, aged 4–12 years with a mean of 9.2 years. These children experienced a total of 17 episodes of meningitis.

Recurrent bacterial meningitis has significant clinical implications as it signals the presence of an underlying pathology. The predisposing factor is a communication between the subarachnoid space and the paranasal sinuses, cribriform plate or petrous pyramid. CSF rhinorrhea or otorrhea is the result of communication between the meningeal space and the base of the skull. All sites of the skull-base leakage potentially lead to the nasal cavity, which is the source of bacterial contamination.

In these patients, a small sealed off vascular cuff of meninges may be trapped in the fracture line providing a port of entry for the organisms. Meningitis in patients with skull trauma is most often caused by *S. pneumoniae*, presumably because these organisms are the predominant commensal of the nasopharynx. An analysis of 280 adult patients with bacterial meningitis revealed that 48 (17 per cent) of the patients had sustained skull and/or facial fractures with dural tear preceding meningitis. A 14-year-old boy with an occult frontal sinus fracture suffered four episodes of meningitis before the old fracture was diagnosed.

Falls are common in children and account for 30–50 per cent of all emergency room visits in urban areas. In one study, 48 children, most of whom were 7 years or younger, sustained 59 injuries. Most injuries were skeletal fractures and internal injuries. There were four skull fractures. The younger children appeared to have minor injuries compared to older ones. The lesser injuries in young children are attributed to their smaller body mass, more resilient and elastic skeleton, more subcutaneous fat cushioning and greater cardiopulmonary reserve.

Children with congenital anatomic defects, such as encephalocele, cranial or spinal dermal sinuses, dermoid cysts, Mondini dysplasias, neurenteric cyst, fibrous bone dysplasia, and persistent craniopharyngeal duct, are also susceptible to recurrent *S. pneumoniae* meningitis.

Immune system disorders are also among the predisposing factors in recurrent bacterial meningitis. Terminal complement components (C5–C8) have an active bactericidal role and their deficiency may lead to recurrent *Neisseria meningitidis* and *N. gonorrhoea* infections, including meningitis.

The use of prophylactic antibiotics for the prevention of bacterial meningitis in patients with skull injuries has been controversial. There have been no studies of immunization for prevention of recurrent meningitis in patients with head injuries. However, in one patient with recurrent pneumocephalic meningitis, the fourth episode occurred after immunization. It is thought that the organisms bypass the circulating serum antibodies by direct invasion of the meninges from the nasopharynx.

**References**

Checklist for Authors

Originality
Does the study make an original scientific contribution or new observation on the topic?

Usefulness
Are the findings likely to contribute to improved standards of care?
Would the findings have an impact on preventive/promotive care?

Design Features
Is the objective of the study clearly defined?
Is the study design appropriate for the objective?
Are the subjects for the study, their source, the method of recruitment as well as the inclusion/exclusion criteria defined?
Are the sampling methods likely to give rise to bias?
Is there a statement included about sample size?
Is the method for collection of data clearly described?
Are all laboratory methods used clearly referenced?
Are the study and comparison groups similar in all respects except for the topic of inquiry?
Is the response rate satisfactory?
Is the method of data collection likely to be open to bias?

If intervention has been used was the allocation random and blind?
Have the outcome measures been defined?
Are there any drop outs?
Was the method of outcome measurement open to bias?

Analysis and Presentation
Is the statistical procedure employed (including the software used) clearly stated?
Are the statistical tests used relevant?
Do the results adequately answer the research question?
Is the interpretation of results reasonable?

References
Are the references relevant to the study and up to date?
Are the references cited in the style required?

Ethics
Are the design and conduct of the study ethical?
Has the permission of the local ethical committee been sought and received?

Adapted from Mother and Child Health: Research Methods (www.tropej.oupjournals.org)