**Retrospective review of invasive pediatric pneumococcal diseases in a military hospital in the southern region of Saudi Arabia**

Mohammed Saeed Al Ayed, Ali Abdullah Hawan

From the *Pediatric Infectious Diseases Department and Department of Microbiology, Armed Forces Hospital, Khams Mushayt, Saudi Arabia*

Correspondence: Dr. Mohammed Al Ayed · Pediatric Infectious Diseases, Armed Forces Hospital, Khams Mushayt, Saudi Arabia · T: +966-7-5428768, F: +966-7-5428309 · drmzayed2000@yahoo.com · Accepted: November 2010

**Ann Saudi Med 2011; 31(5): 469-472**

**PMID:** ****  DOI: 10.4103/0256-4947.84623

**BACKGROUND AND OBJECTIVES:** Invasive pneumococcal disease (IPD) is associated with high case-fatality rates and serious chronic sequelae. The objective of this study was to assess the magnitude of invasive pneumococcal infections in a pediatric population without universal vaccination during childhood in a single hospital.

**DESIGN AND SETTING:** Retrospective review of all pediatric cases of invasive pneumococcal infection during a 7-year period.

**PATIENTS AND METHODS:** We reviewed the microbiological and clinical records of cases of IPD in children <13 years of age admitted to the Armed Forces Hospital, Southern Region, Saudi Arabia.

**RESULTS:** We identified 41 patients with IPD; 27 (66%) were <2 years of age. Four (50%) of those with pneumococcal meningitis were <2 years of age. The case fatality was 3 of 41 (7.3%) due to meningitis and 2 of 41 (5%) due to sepsis, with a case fatality of 5 (12%) due to meningitis and sepsis. Nine patients developed sequelae; of those with meningitis, 5 (73%) developed sequelae. Only 15 (41%) patients had predisposing medical conditions. The overall intermediate and high levels of pneumococcal resistance to penicillin and ceftriaxone were found to be 48.5%, 2.4% and 2.4%, 0%, respectively. None of the pneumococcal isolates were serotyped, and none of the patients had been vaccinated against pneumococcal infections in our hospital.

**CONCLUSIONS:** Despite the presence of a targeted immunization program, a considerable number of cases of invasive pneumococcal infections were reported among our pediatric population over a period of 7 years. Prospective studies in serotypes and antibiotic resistance from the southern region are needed to provide baseline information for the formulation and evaluation of a national prevention and control program.
INVASIVE PNEUMOCOCCAL DISEASE IN CHILDREN

Table 1. Distribution of invasive pneumococcal infections by age group.

| Age (years) | No. (%) of cases |
|-------------|------------------|
| <1          | 16 (39)          |
| 1-2         | 11 (27)          |
| 2-5         | 5 (12)           |
| 6-12        | 9 (22)           |
| Total       | 41 (100)         |

Table 2. Distribution of invasive pneumococcal infections and their outcome by age and body site.

| Age (years) | No bacteremia | Meningitis | Arthritis | No focus | Sepsis | Pneumonia | Total (n= 41) |
|-------------|---------------|------------|-----------|----------|--------|-----------|---------------|
| <1          | 3 (3)         | 1 (0)      | 5 (0)     | 0 (1)    | 3 (0)  | 12 (4)    |               |
| 1-2         | 1 (0)         | 0 (0)      | 5 (0)     | 0 (0)    | 5 (0)  | 11 (0)    |               |
| 2-5         | 1 (0)         | 0 (0)      | 0 (0)     | 0 (0)    | 4 (0)  | 5 (0)     |               |
| 6-12        | 3 (0)         | 0 (0)      | 3 (0)     | 0 (1)    | 2 (0)  | 8 (1)     |               |
| Total       | 8 (3)         | 1 (0)      | 13 (0)    | 0 (2)    | 14 (0) | 36 (5)    |               |

S: number of survivors; D: number of deaths.

RESULTS

Over the 7-year period, we had 41 patients with invasive pneumococcal diseases with ages ranging from 2 months to 12 years. Almost two thirds of the severe cases were in patients within the first two years of life, which is consistent with published data in the literature. The disease spectrum included meningitis in 11 (27%) cases; bacteremias in 13 (32%); sepsis in 2 (05%); bacteremia with pneumonia in 14 (34%) cases, and 1 (2.3%) case with arthritis of the left elbow. Seven of 11 (63%) patients with meningitis were less than 2 years of age, 16 of 41 patients were less than 1 year of age (Table 1), and the case fatality was 3 of 41 (7.3%) due to meningitis and 2 of 41 (5%) due to sepsis (Table 2). Seventy-five percent of the patients with meningitis who survived had chronic sequelae, including bilateral sensorineural hearing loss in 3 (37.5%) cases; sixth nerve palsy in 1 (12.5%) case, convulsion in 2 (25%) cases, hydrocephalus with ventriculoperitoneal shunt insertion in 1 (12.5%) case, delayed motor development in 2 (25%) cases, and some patients had more than one morbid condition. Apart from age as the major factor, other predisposing medical conditions were present in 15 (36.6%) cases (Table 3).

A total of 31 (75.6%) cultures out of 41 demonstrated intermediate or full resistance to at least one antibiotic. Of patients with meningitis, 45% were immediately resistant to penicillin, and none was resistant to ceftriaxone or to vancomycin. Of patients without meningitis, 52% were immediately resistant to penicillin, and only 1 (3.5%) patient was fully resistant. One (3.45%) culture was intermediately resistant to ceftriaxone, and none was resistant to vancomycin. Out of all resistant cultures, resistance to individual antibiotics is shown in Table 4.

DISCUSSION

The incidence of pneumococcal infection varies widely worldwide and even varies within countries.12 The incidence of invasive pneumococcal disease is influenced by age, immunization status and ethnic background.13 According to the medical chart review, none of our patients had received any form of the pneumococcal vac-
cines. Invasive pneumococcal disease was found to be most prevalent early in life, with 39% of the patients aged 12 months. Our results further confirm the presence of a considerable number of cases of pneumococcal infections in young children, which has also been observed in other studies.\textsuperscript{14,15}

The number of cases was relatively small, probably because this hospital serves families of military recruits only and a vaccination program for high-risk patients was implemented only 3 years ago with the 7-valent conjugated pneumococcal vaccine; and 10 years ago, with the 23-valent pneumococcal vaccine for those older than 2 years of age. Another reason may that the population served by our hospital is also eligible to be treated at the Ministry of Health hospitals.

The case fatality was 12.2%; and for those who survived the disease, mainly meningitis, 75% had chronic sequelae affecting his/her quality of life, mostly because of a delay in seeking medical help and nature of the disease. Although the number of isolates was low, the results of antibiotic-susceptibility testing from this study are similar to those of several previous studies from Saudi Arabia and the region except for penicillin, which is more sensitive in our study.\textsuperscript{16-19} Unfortunately, serotyping was not done for any of the isolates because of the lack of facility to do so, but a recent study by Shibl et al (personal communication) showed that 83% of the pneumococcal isolates found in the southern region are covered by the 7-valent conjugated pneumococcal vaccine program.

In conclusion, although in this study the small number of isolates and lack of serotyping are major limiting factors, it showed very obviously the high magnitude and impact of invasive pneumococcal infections in our pediatric population despite the presence of a targeted immunization program. Therefore, adding the 7-valent conjugated pneumococcal vaccine to the national immunization program is a highly justifiable and welcome decision. Prospective studies in serotypes and antibiotic resistance from the southern region are needed to fill in the information gap in our study and to make an important information baseline for the formulation and evaluation of a national prevention and control program.

| Table 3. Predisposing medical conditions in different age groups. |
|---------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Age (years) | Chronic lung disease | Congenital heart diseases | Renal diseases | Splenic dysfunction | Immuno-deficiency state | Previous history of pneumococcal diseases |
| <1 | 1 | 2 | 1 | 1 | 1 |
| 1 < 2 | 1 | 1 | 1 | 1 |
| 2-5 | 1 | 1 | 1 | 1 |
| 6-12 | 1 | 1 | 2 | 1 |
| Total | 2 | 4 | 1 | 4 | 2 | 2 |

*Nephrotic syndrome; $^a$Sickle cell disease; $^b$Non-Hodgkin lymphoma (post bone marrow transplant).

| Table 4. Antimicrobial resistance. |
|---------------------------------|-----------|-----------|
| Antibiotic | Total sensitivity tests | Resistance (n, %) |
| Cotrimoxazole | 38 | 24 (63.2) |
| Tetracycline | 39 | 15 (38.5) |
| Erythromycin | 48 | 16 (33.3) |
| Penicillin | 49 | 1 (2.0) |

$\chi^2=40.5; P<0.001$
REFERENCES

1. Henrichsen J. Six newly recognized types of Streptococcus pneumoniae. J Clin Microbiol 1995;33:2759-62.
2. Howitz M, Valentier-Branth P, Lambertsen L, Christensen JJ. Purulent meningitis 2006. EPI-NEWS 2007; 45. Available from: http://www.ssi.dk/sw62440.asp [Last accessed on 2007 Nov 6].
3. Kyaw MH, Christie P, Jones IG, Campbell H. The changing epidemiology of meningitis and invasive non-meningitis bacterial disease in Scotland during the period 1983-99. Scand J Infect Dis 2003;34:289-98.
4. WHO position paper. Pneumococcal vaccines. Wkly Epidemiol Rec 2007;82:39-104.
5. Centers for Disease Control and Prevention (CDC). Invasive pneumococcal disease in children 5 years after conjugate vaccine introduction—eight states, 1998-2005. MMWR Morb Mort Wkly Rep 2008;57:144-4.
6. Inostroza JA, Vent G, Retamal P, Lorca P, Ossa R, Sorensen RU. Influence of patient age on Streptococcus pneumoniae serotypes causing invasive disease. Clin Diagn Lab 2001;5:556-9.
7. Kaplan SL, Mason EO, Barson WJ, Wald ER, Arndt M, Tan TQ, et al. Three-year multicenter surveillance of systemic pneumococcal infections in children. Pediatrics 1998;102:538-45.
8. Paul J. HIV and pneumococcal infections in Africa. Trans R Soc Trop Med Hygiene 1997;91:632-7.
9. Murray PR, Baron EJ, Pfaller MA, Tenover FC, Yolken RH. Manual of clinical microbiology. 7th ed. Washington, D.C. American Society for Microbiology; 1999.
10. National Committee for Clinical Laboratory Standards. Performance standards for antimicrobial susceptibility testing, 10th informational supplement. Approved standard M100-S10. Wayne, Pa.: National Committee for Clinical Laboratory Standards; 2000.
11. Clinical laboratory standard institute (CLSI) (2001) M100-S11, Performance Standards for Antimicrobial Susceptibility Testing; 19th informational supplement: CLSI; 2001.
12. Marrie T. Pneumococcal pneumonia epidemiology and clinical features. Semin Respir Infect 1999;14:227-36.
13. Hausdorff WP, Feikin DR, Klugman KP. Epidemiological differences among pneumococcal serotypes. Lancet Infect Dis 2003;3:63-8.
14. Escola JA, Takala K, Kela E, Pekkanen K, Kaliokoski R, Leinonen M. Epidemiology of invasive pneumococcal infections in children in Finland. JAMA 1992;268:3323-7.
15. Park IH, Pritchard DG, Cartee R, Brandao A, Brandileone MC, Nahm MH. Discovery of a new capsular serotype (6C) within serogroup 6 of Streptococcus pneumoniae. J Clin Microbiol 2007;45:1225-33.
16. Balkhy MM, Hanan H, Shibi Atef M, Barzouo C, Gray GC. Streptococcus pneumoniae in Saudi Arabia: Antibiotic resistance and serotypes of recent clinical isolates. Int J Antimicrobial. Agents 2004;23:32-9.
17. Invasive Bacterial Infection Surveillance Group, International Clinical Epidemiology Network. Prospective multicentre hospital surveillance of Streptococcus pneumoniae disease in India. Lancet 1999;353:1216-21.
18. Saha SK, Baqui AH, Darmstadt GL. Comparison of antibiotic resistance and serotype composition of carriage and invasive pneumococci among Bangladeshi children: Implications for treatment policy and vaccine formulation. J Clin Microbiol 2003;41:5962-7.
19. Mokaddas EM, Rotimi VO, Albert MJ. Implications of streptococcus pneumoniae penicillin resistance and serotype distribution in Kuwait for disease treatment and prevention. Clin Vacc Immun 2008;15:203-7.