International Journal of Contemporary Pediatrics
Baburaj B et al. Int J Contemp Pediatr. 2023 Jun;10(6):939-942
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291
DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20231505

Case Series

A case series of invasive pneumococcal disease in children

Baburaj B.[1]*, Carol Sara Cherian[1], Jacob Abraham[1], Aneeta Mary Jacob[2]

[1]Department of Paediatrics, [2]Department of Microbiology, Pushpagiri Institute of Medical Science and Research Centre, Thiruvalla, Kerala, India

Received: 22 April 2023
Accepted: 16 May 2023

***Correspondence:**
Dr. Baburaj B.,
E-mail: bbaburaj7@gmail.com

ABSTRACT

Invasive pneumococcal disease (IPD) has a high clinical burden, particularly among children in developing countries. We presented 4 cases of IPD in children who were admitted to Pushpagiri institute of medical science and research centre, Kerala between 2021 and 2022. While our first 3 patients had milder course of disease, our fourth patient who presented with severe pneumonia with pleural effusion had poor outcome. The fact that three out of four of our patients have not received pneumococcal vaccination marks the necessity of this vaccine to prevent IPD in children.

Keywords: *Streptococcus pneumoniae*, IPD, Pediatric, Case series, Developing countries

INTRODUCTION

Streptococcus pneumoniae (*Pneumococcus*) is an important pathogen that kills more than 1 million children each year. Childhood pneumococcal disease is prevalent and typically severe, causes numerous clinical syndromes, and is a major cause of life-threatening pneumonia, bacteremia, and meningitis.[1]

It is a gram-positive, lancet-shaped, polysaccharide encapsulated diplococcus, occurring occasionally as individual cocci or in chains; >90 serotypes have been identified by type-specific capsular polysaccharides. Antisera to some pneumococcal polysaccharides cross-react with other pneumococcal types, defining serogroups (e.g., 6A and 6B). Encapsulated strains cause most serious disease in humans. Capsular Polysaccharides impede phagocytosis. Virulence is related in part to capsular size, but pneumococcal types with capsules of the same size can vary widely in virulence.[1]

Streptococcus pneumoniae infection is one of the most leading etiologies of morbidity and mortality worldwide, particularly among children in developing countries.[2] While *S. pneumoniae* may normally colonize the upper respiratory tract, it has the potential to spread to other organs, causing serious illness.

The term IPD is defined as the finding of *Streptococcus pneumoniae* in a symptomatic patient through culture from normally sterile sites (blood, cerebrospinal fluid, pleural fluid, and joint fluid).[3] The clinical presentations of the disease vary depending on the primary focus. The major clinical manifestations of IPD are pneumonia, bacteremia, and meningitis. In developing countries, the disease burden is high, and mortality rates are higher than in high-income countries.[4]

Invasion of the host is affected by a number of factors. Nonspecific defence mechanisms, including the presence of other bacteria in the nasopharynx, may limit multiplication of *Pneumococci*. Aspiration of secretions containing *Pneumococci* is hindered by the epiglottic reflex and by respiratory epithelial cell cilia, which move infected mucus toward the pharynx. Similarly, normal ciliary flow of fluid from the middle ear through the Eustachian tube and sinuses to the nasopharynx usually prevents infection with nasopharyngeal flora, including *Pneumococci*. Interference with these normal clearance mechanisms by allergy, viral infection, or irritants (e.g.,

smoke) may allow colonization and subsequent infection with these organisms in otherwise normally sterile sites.[1]

CASE SERIES

Case 1

A 6 year old boy presented with complaints of intermittent productive cough since 6 days with no postural or diurnal variations. It progressed to breathing difficulties in the form of increased work of breathing, tachypnea and retractions. H/o of high grade fever since 1day prior to admission.

Child was conscious, oriented. Was febrile at the time of admission with tachypnea and subcostal, intercostal retractions. On auscultation crepitation's heard on right mid zone.

Initial blood investigations showed leukocytosis with neutrophilic predominance (TC 35000 and P 90%). Chest x-ray showed right middle lobe consolidation. He was managed with IV antibiotics (Inj. Moxclav), nebulization and other supportive measures. Blood Culture grew *Pneumococci* 19A strain sensitive to penicillin. Repeat blood counts was normal (TC- 9700 P50). The child has improved symptomatically over the course of hospital stay and advised to continue Moxclav for total 15 days and plan to take pneumococcal vaccine at review.

Case 2

A 3 year old girl child was brought with complaints of fever and ear ache since 3 weeks. Fever was on and off in nature, low grade subsiding with paracetamol. Earache was not associated with ear discharge. Initially she was managed with oral Moxclav for 10 days and cefpodoxime for 7 days. She was brought due to persistence of symptoms.

Initial blood investigations showed neutrophilic leukocytosis (TC-23500). On examination bilateral tympanic membrane was congested and bulging. There was no clinical evidence of meningitis and end organ damage. Blood culture and sensitivity done showed growth of *Streptococcus pneumoniae* 14 strain. She was managed with IV antibiotic (Inj. Cefotaxime) and other supportive measures. ENT consultation was sought and advised to continue same line of management. Repeat counts done were within normal limits. She improved symptomatically during hospital stay and discharged in a hemodynamically stable

Case 3

A 3 year 6 months old female child was admitted with signs and symptoms of meningeal irritation in the form of headache, vomiting and neck stiffness. The illness was started with high grade intermittent fever along with cough and rhinitis of 5 days duration. She received four doses of pneumococcal vaccine. Initial blood investigation showed leukocytosis with polymorph predominance. Child was empirically started on ceftriaxone and other supportive management.

MRI brain showed leptomeningeal enhancement and CSF analysis showed total 500 cells with lymphocytic *predominance*. CSF gram staining showed occasion lanceolated, gram positive cocci resemble *Streptococcus* pneumoniae which was later confirmed with CSF culture. It was sensitive to ceftriaxone, cefotaxime, azithromycin, linezolid and levofloxacin. Blood culture also revealed same organism and strain was 15 C, nonvaccine serotype. Child eventually recovered without any sequelae.

Case 4

A 5 year old female child was brought with c/o dry cough since 5 days, associated with high grade, intermittent fever since 4 days. Child had associated tiredness and reduced appetite. In view of persistent fever she was taken to a nearby clinic and was given oral antibiotic and nebulization. She developed breathlessness one day prior to admission.

On examination child was lethargic, febrile and had tachypnoea and retractions. On percussion, dull note was heard on right side of the lung field with decreased right sided air entry.

This child with above mentioned complaints was admitted in PICU with provisional diagnosis of severe bronchopneumonia. Child had severe respiratory distress, started on IV antibiotics (Meropenem, teicoplanin, azithromycin) needed HFNC support and later changed to NIV. As the respiratory distress worsened, she was intubated and ventilated on the same day of admission. She also required ionotropic support. As the child was found to have right sided pleural effusion ICD was inserted which drained 300 ml of straw colored fluid. Pleural fluid culture showed *Pneumococci* 19A strain. Antibiotics were hiked up as per sensitivity (Vancomycin, Gentamycin). Echocardiogram done was normal. Child was extubated on day 06 of admission and shifted to NIV, she was slowly tapered to HFNC and O2 by mask. Child was initiated on NG feeds on Day 06 of admission. ICD was removed after 08 days.

As the child had recurrence of respiratory distress, emergency CT chest was done which showed right upper and lower lobe collapse with patchy ill-defined consolidation and air bronchogram features could represent cavitating pneumonia/ break down consolidation. Intrapleural fibrinolysis (streptokinase) was done for 04 days and was stopped in view of blood-stained pleural fluid. Fever with worsening distress requiring HFNC support on day 17 of admission. Repeat x-ray done showed worsening of pneumonia with effusion. Child developed cardiopulmonary arrest inspite of all supportive measures and succumb death.

Table 1: Clinical features of pediatric ipd patients admitted to Pushpagiri medical college, Kerala.

Characteristics	Case 1	Case 2	Case 3	Case 4
Age (Years)	6	3	3	5
Sex	Male	Female	Female	Female
Sample collection	Blood	Blood	Blood, CSF	Blood, pleural fluid
Clinical presentation	Fever, cough, fast breathing	Fever, rhinitis, ear ache	Fever, rhinitis headache, vomiting	Fever, cough, breathing difficulty
Vaccination status PCV	Not taken	Not taken	Immunized	Not taken
Antibiotics used	IV Moxclav	IV Cefotaxime	IV Ceftriaxone	IV Vancomycin
Diagnosis	Bronchopneumonia	Otitis media	Acute pneumococcal meningitis	Severe bronchopneumonia with pleural effusion
Pneumococcal strain	19A	14	15C	19A
Length of hospital stay	4 days	3 days	14 days	17 days
Outcome	Good	Good	Good	Died

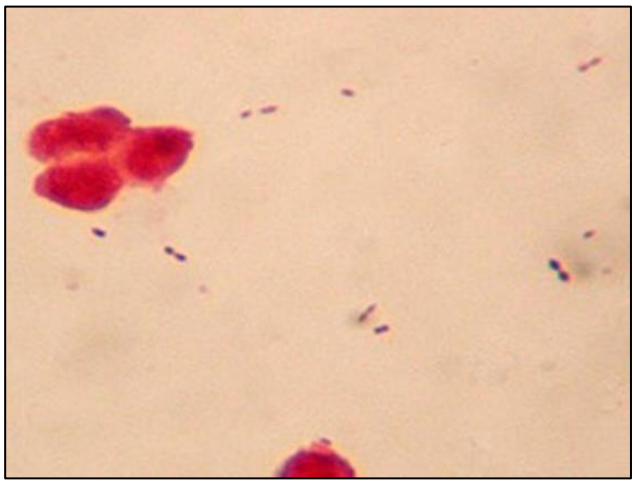

Figure 1: CSF gram stain showing *Streptococcus pneumoniae.*

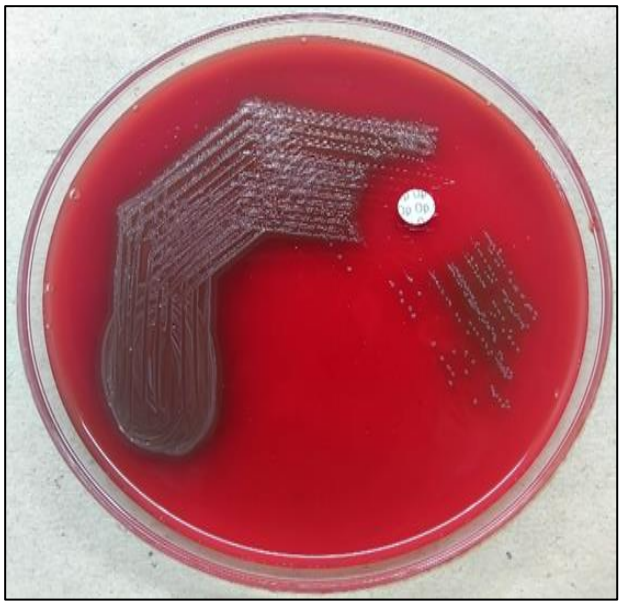

Figure 2: *S. pneumoniae* isolated in CSF culture.

RESULTS

We presented 4 cases of IPD in children who were admitted to paediatric department in Pushpagiri institute of medical science and research centre, Kerala during the time period of 2021-22. All four children with IPD fall in the age group of 2-6 years. Except the third case, all others were not immunized against *Pneumococci*. While our first 3 patients had milder course of disease, fourth patient who presented with Severe bronchopneumonia with right sided pleural effusion had much more severe illness and poor outcome. Bronchopneumonia cases (case 1 and 4) were positive for *Streptococcus pneumoniae* 19A strain (Table 1). The child with pneumococcal meningitis (case 3) was taken full vaccination against *Pneumococci*, but was positive for non vaccine strain (15C)-picture 1 and 2. Fortunately she was recovered completely without any post meningitis sequelae.

DISCUSSION

The transition to IPD is a complex pathologic process that involves different features: the serotype and the consequent pathogenicity of the *Streptococcus* (given by the capsule and the protein pneumolysin), the mucosal features, the immune response of the host (represented by the T cells activation and the action of macrophages), and pre-existing clinical conditions.[6,7] Serotype 3 is the most concerning because it is associated with high mortality rate, worst respiratory failure, and septic shock compared to other serotypes. Fortunately, none of the samples were belongs to serotype 3.[8,9]

Serotype 14,15C,19A are obtained from this study, among them 15C is not covered by PCV vaccination.

CONCLUSION

Complete vaccination against *Pneumococci* can be the best available method for prevention of IPD and its complications. In view of emergence of non-vaccine

strains, it is at most important in developing newer second-generation vaccines which can cover more serotypes.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Kliegman RM, St. Geme J. Nelson textbook of paediatrics 21st edition, chapter 209. 2023;5812-25.
2. O'Brien KL, Greenbaum A. Burden of *Streptococcus pneumoniae* and *Haemophilus influenzae* type b disease in children in the era of conjugate vaccines: global, regional, and national estimates for 2000-15. Lancet Glob Health. 2018;6(7):e744-57.
3. WHO. Surveillance Standards for Vaccine-Preventable Diseases. 2nd ed. World Health Organization. 2018.
4. Arguni E, Wijaya CS, Indrawanti R, Laksono IS, Ishiwada N. Pediatric Invasive pneumococcal Disease (IPD) in Yogyakarta, Indonesia: A Case Series. Glob Pediatr Health. 2022;9:2333794X221108963.
5. National operational guidelines, Introduction of pneumococcal conjugate vaccine, Division Ministry of Health and Family Welfare, Government of India. 2021.
6. Feldman C, Anderson R. Bacteraemic pneumococcal Pneumonia. Drugs. 2011;71:131-53.
7. Dockrell DH, Whyte MK, Mitchell TJ. pneumococcal Pneumonia. Chest. 2012;142:482-91.
8. Demirdal T, Sen P, Emir B. Predictors of mortality in invasive pneumococcal disease: A meta-analysis. Expert Rev. Anti Infect Ther. 2020;31:1-18.
9. Burgos J, Lujàn M, Larrosa MN, Fontanals D, Bermudo G, Planes AM et al. Risk factors for respiratory failure in pneumococcal pneumonia: The importance of pneumococcal serotypes. Eur Respir J. 2014;43:545-53.

Cite this article as: Baburaj B, Cherian CS, Abraham J, Jacob AM. A case series of invasive pneumococcal disease in children. Int J Contemp Pediatr 2023;10:939-42.