

# Invasive disease by *Streptococcus pneumoniae*: a case report and a discussion about the immunization rates in older adults in Brazil

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## Abstract

Invasive disease by *Streptococcus pneumoniae* has a high mortality rate, especially in older adults and children. This paper presents the progression and prognosis of a case of invasive vaccine serotype pneumococcal disease in an elderly woman and promotes a discussion about the monitoring of the pneumococcal vaccine rate among older adults in Brazil.

**Keywords:** *Streptococcus pneumoniae*; Invasive disease; Vaccine; Pneumococcal vaccine.

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## Introduction

*Streptococcus pneumoniae* is a gram-positive coccus that belongs to the normal microbiota of the upper respiratory tract.<sup>1</sup> This pathogen is associated with invasive infections, such as pneumonia, meningitis, sinusitis, endocarditis and bacteremia that affect all ages and genders. These infections present high mortality rates and their evolution is usually acute and aggressive, even with correct antimicrobial therapy.<sup>1-5</sup>

The Advisory Committee on Immunization Practices (ACIP) recommends pneumococcal vaccines for the prevention of pneumococcal diseases. Three vaccines are widely distributed: 10-valent pneumococcal conjugate vaccine (PCV10), 13-valent pneumococcal conjugate vaccine (PCV13) and 23-valent pneumococcal polysaccharide vaccine (PPSV23).<sup>6</sup> Although some of these vaccines are widely available through the public health system, pneumococcal diseases represent an important public health and economic issue in Brazil.<sup>7</sup>

The prevalence of pneumococcal serotypes changes over time and according to stages of economic development. Due to Brazil's continental dimensions, the prevalence of pneumococcal serotypes differs among regions and states. Brazilian studies note that invasive pneumococcal diseases decreased after the implementation of PCV10 in the routine immunization program, but colonization and infections promoted by non-PCV10 serotypes, as such as 3, 6A, 6C, and 19A, persist as an important health public issue.<sup>4,7-9</sup>

Although *S. pneumoniae* is responsible for many invasive diseases,<sup>2-5</sup> as shown in the literature, regular investigation and monitoring of the pneumococcal serotypes involved in aggressive diseases is rare in Brazilian hospitals. In addition, most epidemiological studies focus on the young population,<sup>8-9</sup> with few data on older adults. This paper reports an invasive disease by *S. pneumoniae* vaccine serotype in a woman (Bioethics Committee/CAAE: 01247512.3.0000.5259).

## Case report

A 64-year-old woman was admitted to an emergency room complaining of intense pain in the cervical region, as well as headaches and dysarthria with progressive mental confusion during the previous week. The patient's medical history showed dyslipidemia, Wolff-Parkinson-White syndrome, high systemic blood pressure and splenectomy in childhood.

During the initial clinical exams, the patient presented mental confusion, low arterial pressure and signs that suggested an inflammatory process in the meninges (nape hardness, positive Kernig's sign, and positive Brudzinski's sign).

The patient underwent a computer tomography of the head (CT scan). The blood cell count showed a leukemoid reaction, 36,000 leukocytes with 83% neutrophils and 8% segmented. A lumbar puncture found xanthochromia and hemorrhagic cerebrospinal fluid, with 20cm H<sub>2</sub>O pressure; 213mg/dL of total proteins; 20mg/dL of glucose; 192mm leukocytes<sup>3</sup>; 75% of neutrophils; and 90 mg/dL of lactate.

After admission to the intensive care unit (ICU), the patient stayed in an isolation room and entered sepsis protocol during the first hour. The infectious diseases physician recommended antimicrobial therapy to cover pulmonary and meningeal focuses until the etiologic agent was identified with certainty.

A transthoracic echocardiogram was performed, which showed normal systolic function and diastolic dysfunction with a restricted pattern in the left ventricle and normal function in the right ventricle. It also showed a heterogeneous mobile lesion adherent image, suggesting vegetation with a possible abscess in the mitral valve, moderate tricuspid valve regurgitation, moderate to severe mitral valve regurgitation, and a normal pericardium.

Two of three blood cultures yielded Gram-positive cocci, alpha-hemolytic when cultured on blood agar, with optochin sensitivity. MALDI-TOF (matrix-assisted laser desorption/ionization-time of flight) analysis identified the microorganism as *S. pneumoniae*, with a score higher than 2.0.

The antimicrobial susceptibility test revealed susceptibility to vancomycin, clarithromycin, and ceftriaxone, resulting in the discontinuation of the administration of vancomycin and clarithromycin and the maintenance of the ceftriaxone treatment.

After one day of medical care in the ICU, the patient evolved to acute respiratory failure, prostration, depression in consciousness levels and acute renal failure. The team performed orotracheal intubation, while immediately starting renal dialysis and amine-vasoactive therapy.

After two days, her hemodynamic status aggravated, with 17.6mg/dL of lactate. The patient evolved to disseminated intravascular coagulation, with multiple organ failure, septic shock, and cardiac shock, and died six days after hospitalization.

The PCR protocol,<sup>10</sup> used to identify the capsular polysaccharide, classified the strain as 22F serotype. The strain was stored at -80°C in Tryptic Soy Broth (TSB) (Difco, USA) with 20% glycerol in the Microbiology and Immunology Department of the State University of Rio de Janeiro.

## Discussion and conclusions

*Streptococcus pneumoniae* is a frequent cause of bacterial pneumonia among people of all ages and an important etiological agent of invasive infections, including meningitis and endocarditis.<sup>1</sup> Mortality from pneumococcal infection is at its highest level since the development of penicillin in the early 1940s.<sup>11</sup> Each year, approximately 14.5 million episodes and 500,000 deaths by invasive pneumococcal disease (IPD) occur in children.<sup>12</sup>

Fever is considered a frequent clinical manifestation in pneumococcal endocarditis, and even if both cardiac valves happen to be involved, damage to the aortic valve is the most prevalent.<sup>2</sup> The patient in question did not present fever and the transthoracic echocardiogram showed mitral valve involvement, aspects not commonly found in the literature.

The triad pneumococcal pneumonia, pneumococcal meningitis and pneumococcal endocarditis (Osler's triad), known as the Austrian Syndrome, is associated with a high mortality rate.<sup>5</sup> The patient presented no clinical symptoms suggestive of bacterial pneumonia. However, no investigatory exams were performed, so the syndrome remained undiagnosed. More detailed investigation of the presence of Osler's triad should be performed in patients with invasive pneumococcal infections.

Correct antimicrobial treatment is crucial in the first hours following a suspected pneumococcal infection. According to the European Society of Cardiology guidelines, infective endocarditis due to penicillin-susceptible *S. pneumoniae* requires short-term (2-week) treatment that combines penicillin with gentamicin. Guidelines recommend high doses of cephalosporins or vancomycin for penicillin-intermediate or -tolerant strains without meningitis. Cases with meningitis should be treated with ceftriaxone or cefotaxime alone or in association with vancomycin according to the antibiotic susceptibility pattern.<sup>13</sup> The invasive strain reported was susceptible to all antimicrobial agents usually used for the treatment of pneumococcal infections. Since the exams suggested the presence of meningitis, treatment with ceftriaxone was continued.

The implementation of pneumococcal vaccines in the public health system and the widespread immunization of the population are regarded as effective practices for preventing pneumococcal invasive disease.<sup>6,7</sup> In the Brazilian public health system, the national vaccination protocol includes PCV10.<sup>14</sup> PCV13 is available in private clinics<sup>9</sup> and for cancer and immunocompromised patients, while PPSV23 is suitable for patients with chronic disease, older adults, and indigenous peoples.<sup>14</sup> Although PPSV23 presents purified polysaccharide antigen for 23 serotypes, including serotype 22F, the patient was not tested for immunization.

Increases in life expectancy, the appearance of antibiotic-resistance bacteria and the need to prevent aggressive diseases suggest that pneumococcal immunization in older adults remains a significant public health issue.<sup>15</sup> In Brazil, most papers investigating pneumococcal colonization and their microbiological profile focus on the younger strata of the population.<sup>4,8-9</sup> Few studies report on immunization rates and the prevalent serotypes involved in pneumococcal diseases in older adults, which reveals a gap in the literature. The future development of vaccines and the prevention of IPD in Brazil require further research about the monitoring

and distribution of serotypes associated with invasive infections and the PPSV23 immunization rate in older adults.

Infective endocarditis due to *Streptococcus pneumoniae* is associated with a high mortality rate. This case report shows the poor prognosis and the importance of monitoring pneumococcal disease in Brazil, especially in older adults, as well as emphasizes the importance of monitoring the PPSV23 immunization rate in older adults to prevent invasive pneumococcal infections.

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