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Differences in serotype distribution and dynamics of non-invasive pneumococcal pneumonia and invasive pneumococcal disease

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Objectives: This study aims at comparing the serotype distribution and antimicrobial resistance of isolates recovered from adults (>=18yrs) causing invasive pneumococcal disease (IPD) and non-invasive pneumococcal pneumonia (NIPP). During the 13-year period studied (1999-2011) the 7, 10 and 13-valent pneumococcal conjugate vaccines (PCV7, PCV10 and PCV13) were introduced in childhood immunization in Portugal.

Methods: All IPD isolates and a random sample of 100 NIPP isolates per year were serotyped and tested for antimicrobial susceptibility. Simpson's index of diversity (SID) measured population diversity. Differences were evaluated by the Fisher exact test and the Cochran Armitage test was used for trends. Only $p<0.05$ was considered significant for all tests.

Results: Serotype diversity was high and similar for both infections (SID=0.943 for NIPP and SID=0.941 for IPD). Among 57 different serotypes detected in NIPP and the 60 detected in IPD, only 3 serotypes were common to the groups responsible for more than half of the infections – serotypes 3 (18% and 13%, respectively), 19A (5% and 8%, respectively) and 14 (4% and 8%, respectively). The remaining serotypes in NIPP were 11A (7%), 19F (7%), 9N (4%), 22F (4%) and 23F (4%), while in IPD were 1 (9%), 7F (9%) and 8 (6%). Serotype 3 was consistently the most frequent in NIPP, except for 2009, where it ranked 3rd, following serotypes 19A and 6C. PCV7 potential coverage declined in both infections after its introduction in Portugal. While in IPD this decline occurred abruptly between 2004 and 2005, in NIPP it occurred gradually and over the entire post-PCV7 period. Between 2008 and 2009 there was also a reduction in PCV13 potential coverage in both infections, although in NIPP it was due to a decline in serotype 3 and in IPD to a decline in serotypes 1 and 5. Vaccine serotypes, including those found in the 23-valent pneumococcal polysaccharide vaccine (PPV23) were always more frequent in IPD than in NIPP. When considering the period 2009-2011, PCV13 serotypes comprised 59% of IPD isolates but only 44% of NIPP isolates while PPV23 serotypes represented 80% of IPD isolates and only 66% of NIPP isolates. No major differences were detected between NIPP and IPD regarding antimicrobial resistance. In 2009-2011, penicillin non-susceptibility was 20% in NIPP and 21% in IPD, while erythromycin resistance was 21% in NIPP and 19% in IPD.

Conclusion: NIPP and IPD have their own and distinct serotype distribution and dynamics. Although both infections were affected by PCV7 childhood immunization, the decline in PCV13 potential coverage cannot be solely explained by PCV13 use, since the changes started before the availability of this vaccine.