Serotype distribution of *Streptococcus pneumoniae* invasive isolates in Belarus during 2013-2016

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INTRODUCTION AND PURPOSE

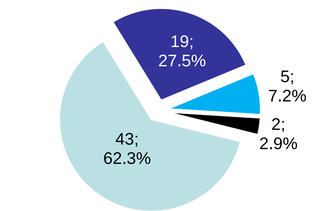
Pneumococcus serotypes distribution has not been studied previously in Belarus. Conjugate vaccines were licensed in Belarus since 2011 (PCV10) and 2012 (PCV13) and were included in the national vaccination schedule since 2012 but only for small high-risk groups (children with immunodeficiency; chronic kidney, heart and lung diseases; chronic hepatitis or cirrhosis; cystic fibrosis). Pneumococcal polysaccharide vaccine (PPSV23) were licensed much earlier. There are no national recommendations on usage of PPSV23 among children or adults, but physicians can prescribe it by their experience.

The aims of the investigation: to determine serotype distribution of invasive pneumococcal disease (IPD) in 2013-2016 in Belarus; to evaluate the extent of serotypes coverage by different vaccines.

METHODS AND MATERIAL

69 cases of IPD were confirmed in the National Reference Laboratory For Invasive Bacterial Diseases (The Republican Research and Practical Center for Epidemiology and Microbiology, Minsk, Belarus) by culture isolation (43/69; 62.3%) or autolysin qPCR detection in clinical specimens (26/69; 37.7%). Material: CSF (43/69; 62.3%), blood (19/69; 27.5%), pleural fluid (5/69; 7.2%), lung autopsy (2/69; 2.9%) are shown in Graph 1. The isolates identification was confirmed by conventional bacteriological methods (growth of the distinctive alpha-hemolytic colonies on blood agar with 5% horse blood, morphology of Gram positive diplococcus, negative catalase test, optochin susceptibility, bile solubility) and molecular detection of autolysin gene using qPCR. DNA extraction from clinical specimens was performed by silica adsorption method using spin columns. Serotyping was performed by conventional multiplex PCR using CDC protocol [1]. Minimum inhibitory concentrations (MICs) of Benzylpenicillin and Ceftriaxone were determined for 40/43 isolates by the broth microdilution reference method using cation-adjusted Mueller-Hinton broth with 5% lysed horse blood according to the methodology described in ISO 20776-1-2006. Susceptibility interpretation was performed according to EUCAST 2016 interpretive criteria using meningitis (≤0.06/>0.06), non-meningitis (≤0.06/>2) and pneumonia (≤1/>2) breakpoints for Benzylpenicillin as well as Ceftriaxone breakpoints (≤0.5/>2) [2].

Graph 1. Types of clinical material



RESULTS

The IPD distribution of serotypes is shown in Graph 2. In <5-year-old children [median – 30 months, LQ–UQ: 14.5–46.5] only five-six serotypes were observed with prevalence of serotypes 14 (42.1%), 19F (21.0%) and 6A/6B (15.8%). All six serotypes are included in PCV13, while 6A serotype (0–15.8%) not included in PCV10 or PPSV23, and 19A serotype (5.3%) not included in PCV10. In patients >5-year-old [median – 43 years, LQ–UQ: 25–57] at least seventeen different serotypes were found with prevalent serotypes: 14 (18.0%), 19F (12.0%) and 1 (12.0%). Circulating non-vaccine serotypes in this age group: 6C/6D, 13, 24F/24A/24B, 35A/35C/42 (2.0% each), which are not included in any of the vaccines. The extent of serotypes coverage by pneumococcal vaccines is shown in Table 1.

Graph 2. Serotype distribution in different age groups

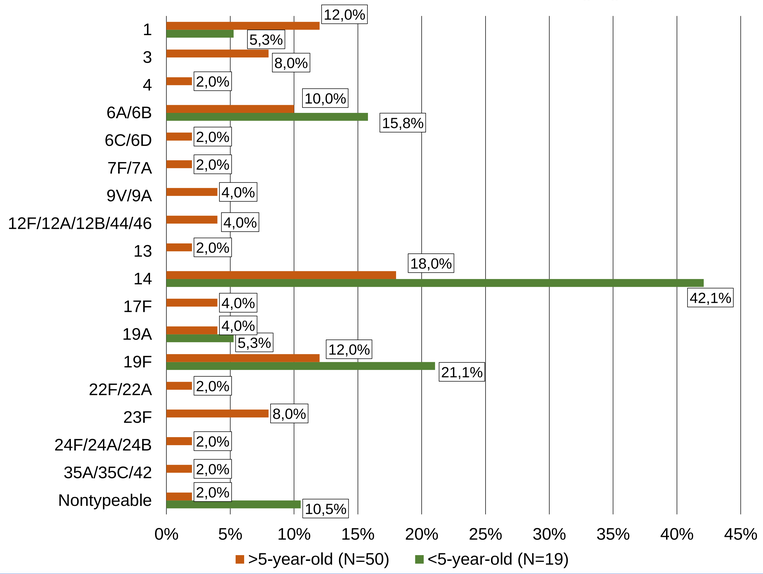


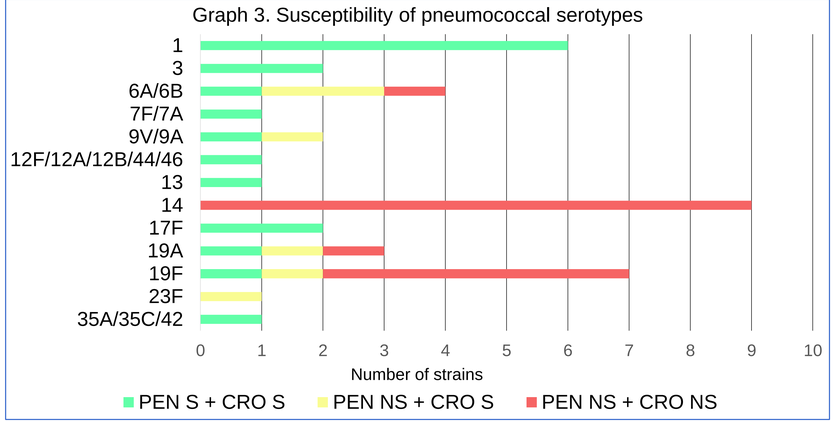
Table 1. Serotypes coverage by different pneumococcal vaccines

Group	PPSV23	PCV10	PCV13
Total (N=69)	78.3–89.6%	60.9–72.5%	82.6%
<5-year-old (N=19)	73.7–89.5%	68.4–84.2%	89.5%
>5-year-old (N=50)	80.0–90.0%	58.0–68.0%	80.0%

RESULTS

Benzylpenicillin and Ceftriaxone non-susceptible IPD isolates are associated with serotypes: 14 (100% / 100%, N=9), 19F (85.7% / 71.4%, N=7), 6A/6B (75% / 25%, N=4), 19A (66.7% / 33.3%, N=3), 9V/9A (50% / 0%, N=2) and 23F (100% / 0%, N=1). The coverage of Penicillin non-susceptible isolates (N=22) by pneumococcal vaccines is 72.7-90.9% for PCV10, 95.5-100% for PCV13 and 81.8-100% for PPSV23. Antimicrobial susceptibility testing results for different serotypes are shown in Graph 3

Graph 3. Susceptibility of pneumococcal serotypes



CONCLUSIONS

Serotype structure in <5-year-old children is characterized with high homogeneity and primary distribution of vaccine serotypes providing the high level (90%) of serotypes coverage by PCV13 and varying levels (68–90%) of coverage by PCV10 and PPSV23, while in >5-year-old patients – with higher diversity with circulation of both vaccine and non-vaccine serotypes providing the lower levels of PCV coverage (58-80%), but high level of PPSV23 coverage (80-90%). Penicillin non-susceptible IPD isolates` coverage level higher than in general pneumococcal population for all vaccines: 72.7-90.9% for PCV10, 95.5-100% for PCV13 and 81.8-100% for PPSV23.

REFERENCES

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