ANTIMICROBIAL SUSCEPTIBILITY OF *STREPTOCOCCUS PNEUMONIAE* ISOLATED FROM ADULTS WITH ACUTE SINUSITIS IN 3 RUSSIAN CENTERS

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L.S. Stratchounski[1], A.A. Tarasov[1], R.S. Kozlov[1], I.A. Edelstein[1], A.I. Kryukov[2], T.A. Alexanyan[2], A.A. Sedinkin[2], J.K. Yanov[3], D.V. Sergeev[3], O.I. Kretchikova[4], M.V. Sukhorukova[4]

[1]Institute of Antimicrobial Chemotherapy, Smolensk, Russia, [2] Moscow Scientific and Practical Center of Otolaryngology, Moscow, Russia,
[3] Research Institute of Ear, Throat, Nose and Speech, St. Petersburg, Russia, [4]Smolensk Regional Center for Sanitary and Epidemiological Surveillance, Smolensk, Russia

P.O. Box 5, Smolensk, 214019, RUSSIA
e-mail: str@antibiotic.ru
www.antibiotic.ru

Abstract

Objectives: The purpose of this study was to determine the susceptibility of the *Streptococcus pneumoniae* causing acute sinusitis (AS) in adults.

Methods: A total of 142 *S. pneumoniae* isolated from aspirates obtained via maxillary sinus punctures in Smolensk (S), Moscow (M) and St. Petersburg (SP) were studied. Susceptibility to penicillin G, amoxicillin, amoxicillin/clavulanate, cefotaxime, cefepime, erythromycin, azithromycin, clarithromycin, clindamycin, tetracycline, levofloxacin, moxifloxacin, chloramphenicol and co-trimoxazole was determined by broth microdilution according to NCCLS (2003) guidelines.

Results: The most active antimicrobials were amoxicillin, amoxicillin/clavulanate, cefotaxime, cefepime, levofloxacin and moxifloxacin to which no resistance was found. Intermediate resistance to penicillin G was 4.2% (6.5%, 4.3% and 1.8% in S, M and SP, respectively). Proportion of non-susceptible strains to macrolides, chloramphenicol and clindamycin was 1.4% (S-0%, M-4.3%, SP-1.8%), 4.9% (S-3.2%, M-4.3%, SP-7.0%) and 0.7% (S-0%, M-0%, SP-1.8%), respectively. The highest percentage of non-susceptible isolates was found to tetracycline and co-trimoxazole - 28.2% (S-30.6%, M-30.4%, SP-24.6%) and 41.6% (S-35.4%, M-30.4%, SP-52.7%), respectively.

Conclusion: *S. pneumoniae* retained susceptibility to aminopenicillins, cephalosporins and respiratory fluoroquinolones. The highest non-susceptibility was found to tetracycline and co-trimoxazole, substantially compromising possibility of their usage for empiric therapy of AS.

Introduction and Purpose

AS is one of the most frequent diseases in ENT practice. This disease is diagnosed in all age groups and often is a complication of pre-existing acute viral infection. There are about 10 mln. people seeking medical assistance due to AS in Russian Federation annually.

S. pneumoniae is the most common pathogen causing acute sinusitis. The review of sinus aspiration studies that have been performed in adults with AS showed that it was isolated in approximately 20-40% of aspirates. During the last decade a substantial increase of antimicrobial resistance of *S. pneumoniae* has been seen. .

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Methods

This study is a prospective microbiological multicentre study. From September 2000 to April 2003, 3 centers in Smolensk, Moscow and St. Petersburg participated in this study. Adult patients with acute sinusitis were included into the study. Clinical specimens were obtained via maxillary sinus puncture. Immediately aspirates were placed in a modified Stuart medium (Copan, Italy) and sent to central laboratory of Institute of Antimicrobial Chemotherapy.

Specimens were plated onto blood agars and incubated in CO_2 atmosphere. All strains were stored at -70°C on 30% trypticase-soy glycerol broth.

Antimicrobial susceptibility testing was conducted by broth microdilution method. Cation-adjusted Muller-Hinton broth (BBL, USA) with 2-5% lysed horse blood was used. Incubation at +35°C in ambient air for 20-24 h was employed. Interpretation of results was done in accordance with the NCCLS standards (2003). *S. pneumoniae* strains were tested to: penicillin G, amoxicillin, amoxicillin/clavulanate, cefotaxime, cefepime, erythromycin, azithromycin, clarithromycin, clindamycin, tetracycline, levofloxacin, moxifloxacin, chloramphenicol and co-trimoxazole. *S. pneumoniae* ATCC 49619 was used for quality control.

Results

A total of 142 strains of *S. pneumoniae* were studied in Smolensk (n=62), Moscow (n=23) and St. Petersburg (n=57). Susceptibility testing results for each center are summarized in Fig.1.

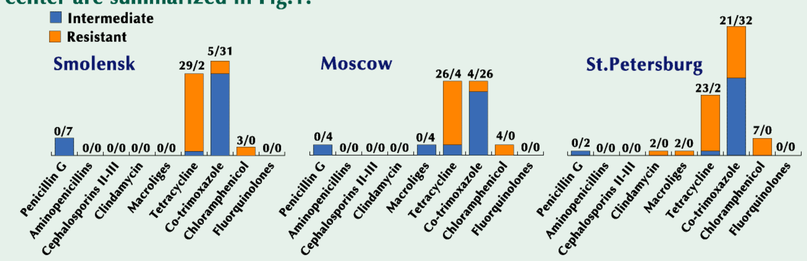

Figure 1. Resistance of *S. pneumoniae* causing acute sinusitis in different Russian centers (%)

MIC distributions, MIC_{50} and MIC_{90} of tested antimicrobials are summarized in Table 1.

The most active antimicrobials were amoxicillin, amoxicillin/clavulanate, cefotaxime, cefepime, levofloxacin and moxifloxacin to which no resistance was found. The overall prevalence of penicillin G resistance was 4.2%,being 6.5%, 4.3% and 1.8% in Smolensk, Moscow and St. Petersburg, respectively. Proportion of non-susceptible strains to macrolides, chloramphenicol and clindamycin was 1.4% (0% in Smolensk, 4.3% in Moscow, 1.8% in St. Petersburg), 4.9% (3.2% in Smolensk, 4.3% in Moscow, 7.0% in St. Petersburg) and 0.7% (0% in Smolensk, 0% in Moscow, 1.8% in St. Petersburg), respectively. The highest percentage of non-susceptible strains was found to tetracycline and co-trimoxazole, being 28.2% and 41.6%., respectively. Resistance rates to co-trimoxazole were higher in St. Petersburg (52.7%) and In total 7 strains (4.9%) of *S. pneumoniae* were multidrug-resistant with phenotypes of resistance shown in Table 2.

Table 1. Activity of antibiotics against *S. pneumoniae* isolated from adults with AS

Antibiotic	Interpretative categories	S, %	I, %	R, %	MIC50 mg/L	MIC90 mg/L	MIC Range, mg/L
Penicillin G	S≤0.064 R≥2	95.8	4.2	0	0.064	0.064	0.016-0.5
Amoxicillin	S≤2 R≥8	100	0	0	0.032	0.032	0.032-0.125
Amox/clav	S≤2 R≥8	100	0	0	0.032	0.032	0.008-0.25
Cefotaxime	S≤1 R≥4	100	0	0	0.016	0.016	0.008-0.064
Cefepime	S≤1 R≥4	100	0	0	0.064	0.064	0.008-0.25
Clindamycin	S≤0.25 R≥1	99.3	0	0.7	0.032	0.064	0.016-1
Erythromycin	S≤0.25 R≥1	98.6	0.7	0.7	0.032	0.032	0.016-2
Azithromycin	S≤0.5 R≥2	98.6	0.7	0.7	0.064	0.064	0.032-8
Clarithromycin	S≤0.25 R≥1	98.6	0.7	0.7	0.032	0.032	0.016-2
Tetracycline	S≤2 R≥8	71.8	2.1	26.1	0.25	16	0.25-64
Co-trimoxazole	S≤0.5 R≥4	58.5	30.3	11.3	0.5	4	0.064-16
Chloramphenicol	S≤4 R≥8	95.1	0	4.9	2	2	0.5-16
Levofloxacin	S≤2 R≥8	100	0	0	0.5	0.5	0.25-1
Moxifloxacin	S≤1 R≥4	100	0	0	0.125	0.125	0.032-0.25

Table 2. Cross-resistance among *S. pneumoniae*

Phenotype	No. of strains	No. (%) of strains also resistant to					
		Penicillin G	Clindamycin	Erythromycin	Tetracycline	Co-trimoxazole	Chloramphenicol
Penicillin G resistant	6		1 (16.7%)	1 (16.7%)	4 (66.7%)	4 (66.7%)	0 (0.0%)
Tetracycline resistant	40	4 (10.0%)	1 (2.5%)	2 (5.0%)		26 (65.0%)	6 (15.0%)
Co-trimoxazole resistant	59	4 (6.8%)	1 (1.7%)	1 (1.7%)	26 (44.1%)		5 (8.5%)
Chloramphenicol resistant	7	0	0	0	6 (85.7%)	5 (71.4%)	

Conclusions

1. The most active *in vitro* antimicrobials against *S. pneumoniae* were aminopenicillins, III-IV generation cephalosporins and new fluoroquinolones.
2. All macrolides retained their high activity (> 98%) against pneumococci.
3. The highest non-susceptibility was found to tetracycline and co-trimoxazole, substantially compromising possibility of their usage in sinusitis.