

CURRENT STATE OF GRAM-NEGATIVE HOSPITAL-ACQUIRED URINARY TRACT INFECTIONS IN RUSSIAN INTENSIVE CARE UNITS: PATHOGENS AND THEIR RESISTANCE PHENOTYPES

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POSTER Nr. 1632

INTRODUCTION

Hospital-acquired infections present a difficult problem for healthcare, especially for intensive care units (ICUs), where risk for nosocomial infections is up to several times greater than in other wards. Nosocomial urinary tract infections in ICU patients are among most common. Still gram-negatives are the main nosocomial pathogens in majority of ICUs, we conduct our study to obtain data about main gram-negative pathogens responsible for nosocomial urinary tract infections in Russian ICUs and their antimicrobial resistance.

METHODS

During prospective multicenter microbiology study participating centers collected strains from ICU patients with documented nosocomial urinary tract infections during 2002-2004. Duplicate isolates were excluded from the study. Strains were transferred to central laboratory in Smolensk. Before antimicrobial susceptibility testing strains were stored at -70°C. In central laboratory minimal inhibitory concentrations (MICs) of amikacin, amoxicillin/clavulanic acid, ampicillin, cefepime, cefoperazone, cefoperazone/sulbactam, cefotaxime, cefotaxime/clavulanic acid, ceftazidime, ceftazidime/clavulanic acid, ceftriaxone, ciprofloxacin, ertapenem, gentamicin, imipenem, levofloxacin, meropenem, moxifloxacin, piperacillin, piperacillin/tazobactam, ticarcillin/clavulanic acid were determined by agar dilution in accordance with NCCLS guidelines (2003-2004). To interpret results of cefoperazone/sulbactam testing breakpoints for cefoperazone were used. Intermediate strains were included into the resistant category. *E. coli* ATCC 25922 and *E. coli* ATCC 35218 were used as quality control strains. Data management and statistical analysis were performed with M-lab® software (Institute of Antimicrobial Chemotherapy, Smolensk, Russia).

Isolates of *E. coli* and *K. pneumoniae* were suspicious of extended spectrum β -lactamase (ESBL) production with MIC of ceftazidime or cefotaxime ≥ 2 mg/l. For all suspicious strains phenotypic confirmation was considered as a ≥ 3 -twofold-decrease in MIC of either cephalosporin in the presence of clavulanic acid compared to its MIC when tested alone or as a results of positive double disk synergy test.

RESULTS

A total of 396 nosocomial gram-negative urinary strains were obtained in the frame of Russian country-wide microbiological study during 2002-2004 from ICU patients. The most common uropathogens were *P. aeruginosa* (30.8%), *E. coli* (25.8%), *K. pneumoniae* (11.1%), followed by *A. baumannii* (7.3%), *Enterobacter* spp. (5.8%), *S.marcescens* (4.5%), *Proteus* spp. (3.8%) and other gram-negative rods (10.9%) (figure 1).

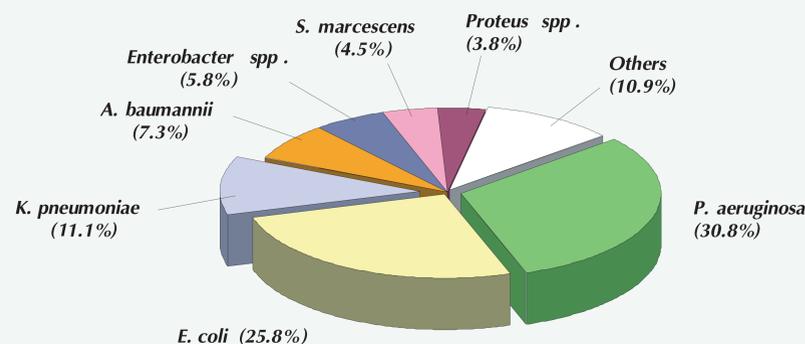


Figure 1. Gram-negative pathogens of nosocomial urinary tract infections in Russian ICUs.

Antimicrobial resistance rates (I+R, %) of main uropathogens - *P. aeruginosa*, *E. coli* and *K. pneumoniae* are shown on figures 2-3.

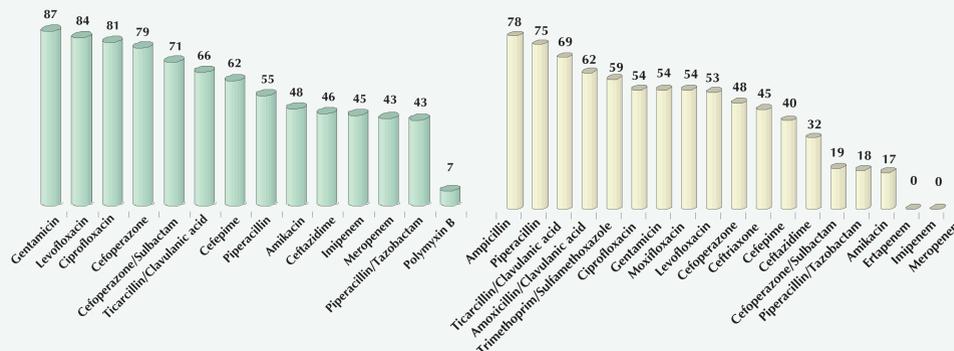


Figure 2. Antimicrobial resistance rates (I+R, %) of *P. aeruginosa* (n=122).

Figure 3. Antimicrobial resistance rates (I+R, %) of *E. coli* (n=102).

High level of penicillin and cephalosporin resistance in *E. coli* and *K. pneumoniae* can suppose wide spread of ESBL-production in these pathogens. Basing on results of phenotypic test of ESBL detection we found 45% (46 of 102) *E. coli* strains and 70.5% (31 of 44) *K. pneumoniae* strains as ESBL-positive (figures 5-6).

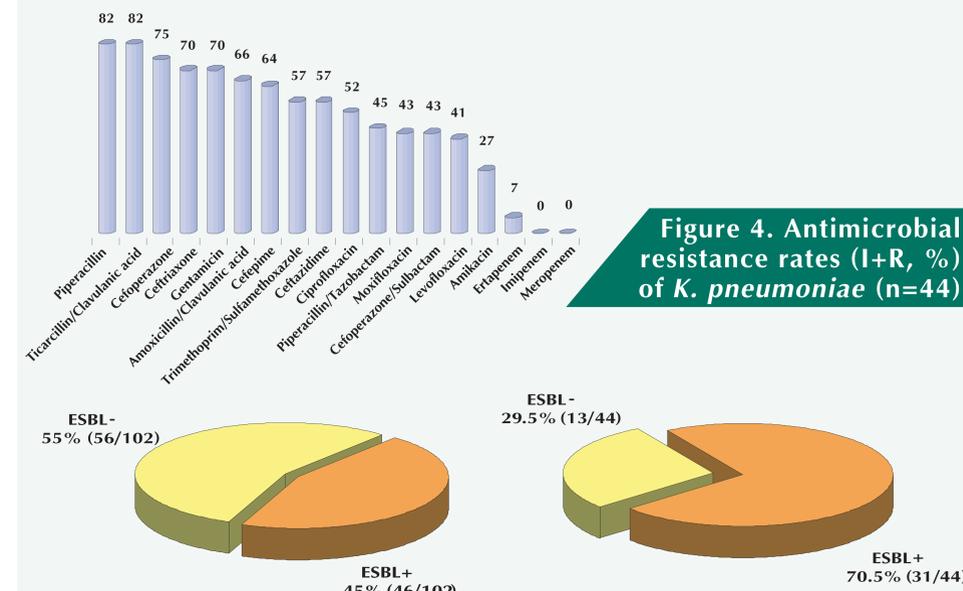


Figure 5. ESBL-production in *E. coli*.

Figure 4. Antimicrobial resistance rates (I+R, %) of *K. pneumoniae* (n=44).

Figure 6. ESBL-production in *K. pneumoniae*.

All ESBL-producing strains were susceptible to imipenem and meropenem. 3/31 of ESBL positive *K. pneumoniae* were unsusceptible to ertapenem, while all ESBL-producing *E. coli* remained susceptible.

CONCLUSIONS

- P. aeruginosa*, *E. coli* and *K. pneumoniae* are the main gram-negative nosocomial uropathogens in Russian ICUs patients.
- P. aeruginosa* were highly resistant to all tested antimicrobials except polymyxin B, thus leaving virtually no choices for therapy in terms of acceptable patient safety.
- Cefoperazone/sulbactam, piperacillin/tazobactam, amikacin exhibited considerable activity versus *E. coli*, while *K. pneumoniae* were more resistant to them.
- High level of ESBL production was found in *E. coli* and *K. pneumoniae* (45% and 70.4%, respectively).
- Imipenem, meropenem, ertapenem showed prominent activity against *E.coli* and *K.pneumoniae*, including ESBL-producing isolates.