which prevents the process of fusion of the viral and cell membranes. Using sequential passages, a laboratory selection of camphecene-resistant strains was carried out and the resistance-conferring mutation V458L located in the HA2 subunit was localized. When comparing the properties of the control and camphecene-resistant strains, it was shown that the pathogenicity of the latter for animals was at least 50 times lower than for a strain passaged without camphecene. No mortality was observed in group of animals inoculated with the resistant virus regardless of the infectious dose of the virus.

Thus, camfecine is a new promising anti-viral compound with a different mechanism of action and a different target as compared to those already used in the clinic.

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## COMBINED ANTIBACTERIAL ACTIVITY OF ANTIMICROBIAL PEPTIDES AND ANTISEPTIC AGENTS

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Antimicrobial peptides (AMPs) are potent bactericidal molecules of innate immune system effective against antibiotic-resistant bacteria.

In this study we investigated the action of highly membranolytic AMP protegrin-1 (PG1) and of a goat bactenecin 3.4 kDa (ChBac3.4) from bactenecins' family, which members possess also intracellular targets, in combinations with a number of antiseptic agents against antibiotic-resistant clinically isolated bacteria *Escherichia coli* ESBL 521/17 (resistant to ampicillin, amoxicillin/clavulonic acid, cefotaxime, ceftazidime, cefixime, aztreonam, netilmicin, ciprofloxacin, trimethoprim/sulfamethoxazole), *Pseudomonas aeruginosa* MDR 522/17 (meropenem, ceftazidime, cefixime, amikacin, gentamycin, netilmicin, ciprofloxacin, colistin), *Klebsiella pneumoniae* ESBL 344/17 (ampicillin) and *Acinetobacter baumannii* 7226/16 (imipenem, gentamicin, tobramycin, ciprofloxacin, trimethoprim/sulfamethoxazole), *Staphylococcus aureus* 1399/17 (ampicillin, oxacillin, gentamicin, amikacin, ofloxacin), *Staphylococcus epidermidis* isolates 9/17, 10/17, 24/17, 33/17 (various fluoroquinolones), and against laboratory ampicillin-resistant strain *Escherichia coli* ML-35p.

Based on fractional inhibitory concentration indices (FICI) assessed by checkerboard titration (FICI ≤ 0.5 synergy; 0.5 < FICI ≤ 1 additivity; 1 < FICI ≤ 2 independent action; FICI > 2 antagonism), AMPs and sodium hypochlorite were found to be antagonistic. Most numerous and prominent cases of synergy were revealed in combinations of AMPs with poviargolum (a colloidal silver preparation), that corresponds with previous studies on AMPs and silver nanoparticles interaction. In combination with dioxidin PG1 showed synergy against gram-positive bacteria and ChBac3.4 against *A. baumannii* 7226/16 and *K. pneumoniae* ESBL 344/17. Prontosan was synergistic with AMPs against gram-positive bacteria and with PG1 also against *E. coli* ML-35p. Etidronic acid, that was shown to inhibit β-lactamases, acted synergistically with AMPs against *E. coli* strains and *S. aureus* 1399/17 and in case of ChBac3.4 also against *A. baumannii* 7226/16 and *S. epidermidis* 33/17. Besides sodium hypochlorite other cases was mostly additive. Using resazurin metabolic marker we found that dioxidin and prontosan significantly hasten the effect of PG1, and poviargolum of both AMPs, on the metabolic activity of bacteria. Thus, combined use of AMPs with antiseptics has perspectives.

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## EVALUATION OF THE EFFECTIVENESS OF PNEUMOCOCCAL VACCINES FOR PREVENTION OF COMMUNITY-ACQUIRED PNEUMONIA IN SERVICEMEN

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In 2011 13-valent pneumococcal conjugate vaccine "Prevenar 13" (PCV13) was licensed in our country. It is more immunogenic, induces stronger immunity than non-conjugate polysaccharide vaccines Pneumo 23 and Pneumovax 23 (PPV23). In this regard, PCV13 appears to be preferable for the prevention of pneumonia in military personnel than PPV23 which is used now.

The aim of the study was to conduct testing of PCV13 for the prevention of pneumonia in military teams, to compare the epidemiological effectiveness of conjugate and non-conjugate polysaccharide pneumococcal vaccines.

The study was conducted in 3 groups of conscripts. In the first group of soldiers of 571 people, 407 (71.3%) were vaccinated with PCV13. In the second group of 663 people, 472 (71.2%) were vaccinated with pneumococcal polysaccharide vaccines (PPV23). The third group, which included 493 unvaccinated soldiers, formed a comparison group. All military personnel were recruits of the same age (18–22 years) and were in comparable conditions of service and life.

During 5 months of follow-up, the incidence of community-acquired pneumonia among vaccinated by PCV13 was 4.5 times less than in the comparison group, and among vaccinated by PPV23 — 2.8 times less ($p < 0.001$). The index of effectiveness of PCV13 (4.5) was 1.6 times higher than that of PPV23 (2.8). The indicator of the effectiveness of PCV13 made up of 77.7%, PPV23 — 64.3%. Thus, the epidemiological efficiency of PCV13 was 1.2 times higher than that of PPV23.

In the first and second groups of servicemen, the incidence of pneumonia was lower than in the comparison group, not only among vaccinated, but also among unvaccinated. Moreover, the incidence of pneumonia among those not covered by vaccination in the group where PCV13 was used was 1.6 times lower than in the group where PPV23 was used ($p < 0.001$), which is explained by the formation of a stronger collective immunity preventing the circulation of pneumococci during vaccination with conjugated vaccine.

On the basis of the data obtained, it is preferable to vaccinate recruits a month before the call and conscripts, not vaccinated before the call to the armed forces of the RF, by pneumococcal conjugate vaccine.