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ANTIBIOTIC SENSITIVITY OF CLINICAL ISOLATES AT OUTPATIENT UNIT IN TVER, RUSSIA: A COMPARATIVE STUDY

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ABSTRACT — BACKGROUND Discovery of antibiotics opened a new era in the treatment of bacterial diseases. However, the microorganisms are able to adapt and resist the effects of the drugs.
OBJECTIVE Our study is aimed to investigate the sensitivity of clinical specimens to antibiotics.
METHODS Clinical samples of 280 case record forms were collected at departments of surgery, urology and otorhinolaryngology in an ambulatory clinic (Tver, Russia) during 2019. The results of microbiologically assessed isolates from pharynx, nose, ears, eyes, wounds, sputum and urine underwent statistical analysis.
RESULTS The outcomes confirmed a general trend of reduced susceptibility of bacteria to antibiotics. The worst result was shown by protected Amoxicillin; practically no microorganisms were sensitive to it. Protected Cephalosporins Cephalosporins of IV generation and Imipenem were among the best, although not highly sensitive to all the pathogens.
CONCLUSION United efforts of all states are required to combat the growing antibiotic resistance. It is necessary to adhere to strict regulations on dispense of antibiotics in pharmacies and the use of antibiotics therapy.

KEYWORDS — antibiotics, sensitivity to antibiotics, bacterial infection, antibiotic resistance.

INTRODUCTION

The discovery of penicillin was a real breakthrough in the treatment of infectious diseases, for which Alexander Fleming, Ernst Chain and Howard Flory received the Nobel Prize in 1945. Then a series of discoveries of antibiotics followed: streptomycin, tetracycline, chloramphenicol. By 1980, there were more than 100 different antibiotics. However, after 4 years of widespread use of penicillin, effectively untreatable infections appeared. Bacteria have accumulated special protective mechanisms and have developed resistance to antibiotics. [1, 2].

Currently, antibiotic resistance is defined by the World Health Organization (WHO) as a major global challenge that requires immediate joint action to solve it [3]. There are several priorities to combat the increasing resistance of bacteria to antibiotics. Among them: a restricted use of antibacterial drugs for upper respiratory infections; avoiding antibiotics facilitating microbial growth; choosing antibiotic treatment with the account of its resistance and safety; adequate dosage and period of the therapy; prescribing antibiotics in optimal pharmaceutical form. And finally: development and introducing new antibacterial chemotherapy drugs into the practice. But as it is seen on practice, in some time, quite promptly, antibiotic resistance occurs. However, the pharmaceutical industry is reluctant to develop new antibacterial drugs. [4, 5]. Therefore all existing antibiotics were divided into 3 groups: access, observation, and reserve [5]. This separation was made in order to maintain the sensitivity of bacteria to at least some drugs and thus save a human life.

Originality of our study lies in investigating local antibiotic resistance within one medical institution. The geographic location of Tver region is at the borderline to Moscow, which allows indirect use of portal https://amrmap.ru/ to estimate resistance of microorganisms to antibacterial drugs [6, 7]. However, Tver medical institutions do not participate in this federal program. Therefore, the task of a doctor is to prescribe an adequate treatment with the account of possible sensitivity of microorganisms, which may vary in the conditions of a hospital or an outpatient unit.

OBJECTIVE

A comparative bacteriological study was aimed to evaluate bacteria isolated from clinical material and to get a general picture of sensitivity of most common bacteria to commonly used antimicrobials.

MATERIALS AND METHODS

280 case record forms of clinical materials underwent microbiological assessment and were statistically processed. Isolated specimens of wound tissues, pharynx, nose, eyes, ears, as well as sputum and urine were collected during the appointments with surgeons, urologists and otolaryngologists at Outpatient Clinic N1 of Tver City Hospital N7 (Tver, Russia) in the course of 2019. Clinical samples were collected by

a swab and placed in the tubes containing AMIES transport medium (APEXLAB, China). The samples were delivered to the laboratory within 40 minutes of collection. Bacteriological assessment of the clinical isolates was carried out in selective and differential growth medium, such as Endo agar, salt egg yolk agar, blood agar. Classical microbiological methods for an anaerobic condition at the temperature of 37° C were employed. After isolation of a pure culture, morphological and biochemical identification was performed. We followed clinical recommendations „Defining the susceptibility of microorganisms to antimicrobic drugs"(2014) to classify their susceptibility according to international European System EUCAST. Susceptibility to antibiotics of the isolated strains was tested employing diffusion method with Oxoid disks, UK followed by calculation of the degree of deviation for zone diameters. Microsoft Excel 2016 was used for statistical analysis of the data.

RESULTS AND DISCUSSION

The study revealed that Gr + microflora prevails in the overall picture of the microbiological profile, among the members of which Staphylococcus aureus (25.6%) and hemolytic streptococcus (17.1%) were most often grown. Among members of Gr-microorganisms, Escherichia coli were leading (21.9%).

this family showed rather high sensitivity to amikacin and cefepime (90.0%).

The strains seeded with E. Coli also proved to be less sensitive to ammoxicillin/clavulanate (36.8%). At the same time, their sensitivity to amikacin was rather low (59.7%), as well as third-generation cephalosporins: ceftriaxone and cefotaxime (62.5% and 66.7%, respectively). The highest antibacterial activity against Escherichia coli was found in fourth-generation cephalosporins: cefipim (100%) and protected cephalosporins: cefoperazole/sulbactam (100%).

Among all seeded pathogens, K. Pneumonia and P. Aeuruginosa displayed most multidrug resistance to antibiotics. Klebsiella pneumoniae was found to be most sensitive only to cefoperazole/sulbactam. The remaining antibiotics showed insufficient activity against seeded strains. Especially paradoxical this picture of resistance looks with respect to IV generation cephalosporins (cefepime — 61.5%), fluorinated quinolones (ciprofloxacin — 50.0%) and III generation aminoglycosides (amikacin — 42.9%). The complete resistance of Pseudomonas aeruginosa to amoxicillin / clavulanate and a sharp decrease in sensitivity to all cephalosporins, including protected ones, up to complete resistance to ceftriaxone, also look paradoxical. At a very high level, P. Aeuruginosa remains susceptible to amikacin, imipenem and ciprofloxacin.

Table 1. *Sensitivity of surgical profile pathogens to antibacterial drugs (%)*

	E. aerogenes	E. Coli	K. pneumonia	Pseudomonas aeuruginosa	S.aureus	St. pyogenes
Amikacin	90,0	59,7	42,9	100	25,0	75,0
Amoxicillin / clavulanate	44,4	36,8	36,4	0	14,3	65,3
Imipenem	80,0	88,9	38,5	100	66,7	72,8
Cefepim	90,0	100	61,5	35,3	77,8	100
Cefoperazone / sulbactam	81,8	100	90,9	33,3	100	100
Cefotaxime	72,7	66,7	50,0	29,7	88,9	100
Ceftriaxone	75,3	62,5	46,1	0	88,9	76,4
Ciprofloxacin	78,2	71,4	50,0	78,1	88,9	61,8

We investigated the sensitivity of most frequent pathogens to antibiotics commonly used in medical practice. Our outcomes showed reduced sensitivity of bacteria E. Aerogenes to most antibiotics, especially to Amoxicillin/clavulanic acid (44.4%). This may be attributed to the fact that in more than 25% of cases this drug is prescribed for the treatment of ENT infection (analytical data of DSM Group). However, bacteria of

A low sensitivity of Staphylococcus aureus to protected amoxicillin and amikacin is revealed. At the same time, it should be noted that the isolated strains remain sensitive to most antibiotics, especially to cephalosporins combined with β-lactamase inhibitors. A similar picture is observed for hemolytic streptococcus. It remains sensitive to most antibiotics, which allows the use of amoxicillin as the first choice in the treatment of infections caused by this pathogen. Despite the high sensitivity to most antibiotics, it is not recommended to use cephalosporins of the last generations in these cases, due to the high risk of selection of microorganisms and the occurrence of multiresistance [5].

CONCLUSION

Our results have confirmed a general tendency of increasing insensitivity of various bacteria to antibiotics. Possibly, horizontal transfer of antibiotic resistance genes plays an important role in this process [8, 9]. A pattern of multiresistance is observed in such strains as K. Pneumonia and P. Aeuruginosa, which cause dangerous bacterial diseases and can lead to death. In our study, Staphylococcus aureus and Hemolytic streptococcus have developed least resistance, which enables treating them with antibiotics of a narrower spectrum in order to inhibit the selection of microorganisms and develop resistance. Also, to inhibit the spread of multiresistance, the precautions of working with chemotherapy should be applied, namely: observe the duration of the course, the frequency of administration and dosage. It is recommended to restrict the use of antibiotics for preventive purposes, as well as to forbid self-prescription of antibiotics.

We reiterate the urgency of joint efforts of interdisciplinary medical teams on cross-national level on inhibiting the spread of antibiotic resistance and rationalizing the use of antibiotics at outpatient care.

CONTRIBUTIONS

Authors contributed to the manuscript equally.

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