MONITORING OF ANTIBIOTIC SUSCEPTIBILITY OF MICROBES ISOLATED FROM THE PATIENTS OF TERNOPIL UNIVERSITY HOSPITAL IN 2012 YEAR

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Summary

The results of the study of antibiotic resistance of bacteria isolated from various clinical material of the patients of Ternopil University hospital are presented in this article. Enterobacteriaceae, Pseudomonas spp. and gram- positive cocci dominated in tested material.

About 28,6-75,8 % of Enterobacteriaceae and Pseudomonasa spp. were susceptible to imipenem and amykacin . From 50,0 % to 76,7% strains of E. coli were susceptible to amykacin, cephalosporins of III generation and quinolones**.** Staphylococci had high level of resistance to lincomycin, cefazolin, levofloxacin and rifampicin, but usually were susceptible to vancomycin, oxacillin, methicillin.

As it is known, the considerable increase of number of purulent diseases exciters with multiresistance to antibiotics is observed in the whole world an in Ukraine too. A substantial part of them belongs to the causative agents of various nosocomial infections [Lin 2011].

It is believed, that microbes, which are resistant to one or more antibiotics [Bao et al. 2013], cause about 70 % of infectious diseases.

In September 2001, the World Health Organization accepted global strategy of prevention of microbial resistance to antimicrobial agents spread [Werarak et al. 2010].

The appearance of such program was conditioned by strongly marked global tendency of reducing the susceptibility bacteria to antimicrobial drugs, which often acquires regional peculiarities

So, this program guarantees the effectiveness of such vitally important drugs as antibiotics, not only for the present generation, but also in the future.

Intensive Care Unit (ICU) are often regarded as the epicenter of spread of bacteria which are resistant to antibiotics, as the use of these ones in such wards is in ten times more than in another type of hospital wards

Doctor's practical activities confirms that real monitoring of the spread of bacterial antibiotic resistant strains should be establish in any hospitals [Vogelaers et al. 2010].

As inopportune prescribed adequate and rational antibacterial therapy won't causes necessary eradication of the pathogen, thereby substantially makes disease duration worse, increases the cost or disease treatment, and sometimes patient mortality rate [DiCocco et al. 2009].

For prevention the spread of antibiotic resistant strains the special microbiological passport of any department is recommended to make, and when beginning of antibacterial therapy theses data must be taken into consideration [DiCocco et al. 2009].

Familiar with main trends of resistance of the most important causative agents of nosocomial infections is necessary for the antibiotic choice in concrete as well as for elaboration of programs of empirical antibiotic therapy in the hospital [Prisacari 2013 et al., Polverino et al. 2013].

Aim of investigation: Analysis of the features of antibiotic resistance of microbes isolated from the patients of Ternopil University Hospital during 2012, for the rational selection of antimicrobial agents to be used for further treatment.

Materials and methods

A microbiological monitoring of antibiotic resistance of 231 strains of bacteria isolated from clinical material (oropharyngeal mucus, sputum, tracheal and bronchial aspirate, wounds' discharges.) was performed.

The examination of biological material and interpretation of the results was performed according to generally accepted guidelines [Varivoda et al. 2009]. Berey's classification was used for identification of isolated microorganisms, semiautomatic analyzer «Vitek – 2 compact 15"was used

After primary isolation of causative agent and its identification susceptibility of microorganisms to such antibiotics as: cefoperazone, cefepime, ceftriaxone, ceftazidime, cefotaxime, amikacin, levofloxacin, meropenem, tobramycin, tikartsyllin/clavulanate (for Enterobacteriaceae and gram-negative nonfermentative bacteria – P.aeruginosa, Acinetobacter spp.), oxacillin, vancomycin, azithromycin, lincomycin, rifampicin, cefazolin, cefepime, ciprofloxacin, levofloxacin was perfomed by Kdisc-diffusion (Kirby-Bauer technique) [Varivoda et al. 2009].

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Results and discussion

Analysis of etiological patterns of pathogens isolated from different sources, showed that in patients treated both in the department of anesthesiology and intensive care and abdominal surgery Gram-negative Enterobacteriaceae were dominated, accordingly 53,8 % and 53,2 % of clinical isolates (Table 1). Enterobacter spp., Klebsiella spp., and Escherichia spp. were privailed among isolates.

Gram negative nonfermentative bacteria (P. aeruginosa), wa isolated in 10 % of patients of the of abdominal surgery department and in 25 % of patients from Anesthesiology department.

Table 1. The spectrum of bacteria isolated in different department of Ternopil university hospital

Microorganism	Frequency of microbes revealing, %	
	anesthesiology and intensive care department	aabdominal surgery department
Enterobacter spp.	26,3	11,6
Klebsielal spp.	19,3	6,6
E. coli	7,0	30
Proteus spp.	0,6	5
Citrobacter	0,6	-
P. aeruginosa	25,1	10
Acinetobacter spp.	4,0	-
S. aureus	12,3	30,0
Coagulase negative staphylococci (S. epidermidis, S. saprophyticus, S. haemolyticus)	1,8	3,4
Streptococcus pyogenes	1,8	1,7
Enterococcus spp.	1,2	1,7

Gram-positive cocci (staphylococci and streptococci) were present in 36,8% of patients of abdominal surgery department and 17,1% of patients of anesthesiology department.

Among coagulate positive cocci S. aureus was dominated (Table 1), the incidence of which is in the department of abdominal surgery was 2.4 times higher than in the department of anesthesiology and intensive care. In abdominal surgery department, it was isolated d in 1.9 times more than in anesthesiology and intensive care department.

The analisis of spectrum of microbes, which were isolated in intensive care department, was made for looking after dominant bacteria in the clinic (Table 2).

Table 2. Comparative analysis of microorganism, isolated in anesthesiology and intensive care department in 2009-2012

Microorganism	Frequency of microbes revealing, %	
	2012	2009
Enterobacter spp.	26,3	11,6
Klebsiella spp.	19,3	6,6
E. coli	7,0	30
Proteus spp.	0,6	5
Citrobacter	0,6	-
Pseudomonas aeruginosa	25,1	10
Acinetobacter spp.	4,0	-
S. aureus	12,3	30,0
Coagulase negative staphylococci (S. epidermidis, S. saprophyticus, S. haemolyticus)	1,8	3,4
Streptococcus .pyogenes	1,8	1,7
Enterococcus spp.	1,2	1,7

The dominant bacteria in this department in a period between 2009 and 2012 Gram-negative micro flora (63,2% of all isolated microorganisms in 2009.and it was, and 82,9 %) The frequency of isolation of nonfermentative P. aeruginosa in 2012 increased in 2,5 times as compared with 2009 . The number of isolates of Acinetobacter spp., Enterobacter spp., Klebsiella spp. increased too. At the same time, the isolational frequency of Escherichia coli, and Staphylococcus aureus decreased.

Isolated Enterobacteriaceae, had sufficiently high level of antibiotic resistance to the studyied antibiotics, especially Enterobacter spp. and Klebsiell spp. (Tab. 3).

About 50,0% - 83,8% of clinical isolates of E. coli were resistant to cefoperazone, cefotaxime, ceftriaxone (III generation), amikacin and levofloxacin. Ticarcillin / clavulanic acid and meropenem were the most active against Pseudomonas spp. There were only 41, 9 % -46.5 % of resistant strains

Table 3. Resistance of Enterobacteriaceae and Pseudomonadaceae to antibiotics (%)

Microorganisms	Levofloxacin	Cefoperazone	Cefepime	Cceftazidim	Cefotaxime	Ceftriaxone	Amikacin	Meropenem
Enterobacter	84,4	80	66,7	57,8	62,2	84,4	64,4	66,7
E. coli	50,0	33,3	83,8	58,3	50,0	50,0	58,3	0,0
Klebsiella	78,8	78,8	72,7	72,7	75,8	78,8	60,6	24,2
Ps. aeruginosa	58,3	58,1	60,5	53,5	*	*	58,3	46,5
Acinetobacter	71,4	57,1	71,4	28,5	71,4	85,7	71,4	42,8

Footnote *– didn't examine, as Pseudomonas has natural resistant to theses antibiotics

After primary isolation of causative agent and its identification susceptibility of microorganisms to such antibiotics as: cefoperazone, cefepime, ceftriaxone, ceftazidime, cefotaxime, amikacin, levofloxacin, meropenem, tobramycin, tikartsyllin/clavulanate (for Enterobacteriaceae and gram-negative nonfwrmentative bacteria – P.aeruginosa, Acinetobacter spp.), oxacillin, vancomycin, azithromycin, lincomycin, rifampicin, cefazolin, cefepime, ciprofloxacin, levofloxacin were performed.

It is known that S. aureus is the most frequent causative agents of nosocomial infections in various hospitals and departments [Murray et al. 2007].

Thus, antibiotic resistance of S.aureus isolated in hospital in 2009 and 2012 was analyzed. As a rule, these bacteria had high level of antibiotic resistance.

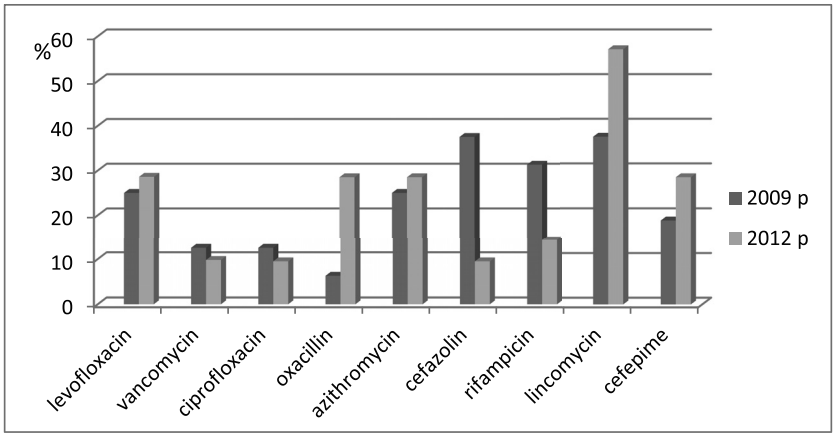

Figure 1. Resistance of S. aureus to antibiotics.

In 2009 high general level of S.aureus resistance to most antibiotics was registered (Fig.1) About 37, 5 % of strains were resistant to lincomycin and cefazolin, 25,0% - to levofloxacin and azithromycin, 31, 3 % - rifampicin. However, over 80 % of isolates maintain susceptibility to vancomycin, oxacillin / methicillin. It should be noted that in 2012 the number of strains which were resistant to oxacillin / methicillin increased in 4,4 times, to lincomycin–in 1,5 times. But in 2012, there were in 3,9 times more sensitive strsins to cefazolin and in 2,2 times to rifampicin than in 2009.

Our results coincide with those that were obtained by another researchers [DiCocco 2009]. Thus, according to the results of observations conducted in Belarus [Varivoda et al. 2009]. Gram-negative Enterobacteriaceae and Pseudomona too, cause more than 50 % of cases of nosocomial infections.

In Russia [Kozlov 2007] Gram-negative flora (77,5 % of isolates) is prevalent too as first microbial infectious complications, Gram-positive bacteria were isolated in 17,4 % of case [Malkova et al. 2012]. It has been shown that Gram-negative pathogens are highly resistant to amino-, carboxy-, ureido-penicillins, cephalosporins of I-II generation, ciprofloxacin. Over 60 % of S. aureus had resistant to beta-lactams, methicillin / oxacillin, to all aminoglycosides and fluoroquinolones I and II generation.

When analyzing data about nosocomial strains of K. pneumoniae and E. coli, it was found a high level of their resistance to amikacin (more than 30 % of strains). About 38 % of Klebsiella spp. and 50 % of E. coli have had resistance to ciprofloxacin. Levofloxacin was more effective than ciprofloxacin against K. pneumoniae, but not E.coli (51-51,3 % of resistant strains, respectively) [Kozlov 2007].

According to monitoring conducted in Ukraine in 2004-2007, imipenem was the most effective antibiotic against Enterobacteriaceae. It Inhibited the growth of 98, 9 % isolated strains. It may be an antibiotic of choice for Pseudomonas spp. [Polishchuk et al. 2010].

Summary

1. Gram negative bacteria such as Enterobacteriaceae (57,8 %) and Pseudomonadaceae (22,5 %) are dominated as causative agents in clinical samples. Gram positive cocci occupies third place (17,3 %).
2. Clinical isolates of bacteria as a rule are resistant to most of investigated antibiotics. Enterobacter spp. have a high resistance to cephalosporins of III - IV generations (57,8 % - 84,4 % of resistant strains). E. coli mainly were resistant to cephalosporins of III generation) - cefoperazone, cefotaxime, ceftriaxone, amikacin and levofloxacin. Pseudomonas spp. had susceptibility to ticarcillin/ clavulanic acid and meropenem, clinical strains of Klebsiella – to amikacin and meropenem. S. aureus usually issusceptible to vancomycin (90,2%), ciprofloxacin, and cefazolin (90,5 %).

List of references

1. Bao L, Peng R, Ren X, Ma R, Li J, Wang Y. et al. (2013), *Analysis of some common pathogens and their drug resistance to antibiotics*. Pak J Med Sci. Jan;29(1), p.135-139.
2. DiCocco JM, Croce MA. (2009), *Ventilator-associated pneumonia: an overview*. 10(9), p. 1461-1467.
3. Kozlov R.S.. (2007), *Modern trends of antimicrobial resistance of pathogens of nosocomial infections in the ICU Russia: what will happen next?* Intensive Care. 4, p.21-30.
4. Lin NT. (2011), *Common antimicrobial-resistant bacteria in nosocomial infections in Taiwan and their prevention.* Institute of Microbiology, Immunology and Biochemistry Tzu Chi University ROC, 58(4), p. 5-10.
5. Malkova O.G., Kuprenkov A.V., Demeschenko V.A. and others (2012), *Infectious safety of patients on mechanical ventilation.* Critical Care. 8, p. 12-21.
6. Murray P. R., Baron E. J., Jorgensen J. H., Landry M. L., Pfaller M. A. (ed.). (2007), *Susceptibility test methods: dilution and disk diffusion methods, Manual of clinical microbiology*. 9th ed. ASM Press, Washington, D.C., p. 1152–1172.
7. Polishchuk A.I., Pokas A.M., Makushenko A.S., Yanovska V.T. (2010), *The problem of antibiotics agents of opportunistic infections in Ukraine, Materials of the All-Ukrainian scientific-practical conference with international participation "Nosocomial infections and methods for determining the mechanisms of resistance to antimicrobial agents."*. Kyiv, p.26
8. Polverino E., Torres A., Menendez R. et al. (2013), *Microbial aetiology of healthcare associated pneumonia in Spain: a prospective, multicentre, case-control study.* HCAP Study investigators.Thorax. Nov; 68(11), p. 1007-1014.
9. Prisacari V, Berdeu I. (2013), *Antimicrobial resistance in septic-purulent infections.* Rev Med Chir Soc Med Nat Iasi. Apr-Jun;117(2), p. 457-64.
10. Varivoda E.B., Tonko O.B., Fisenko E.G., Levshina N.N. (2009), *Microbiological Support for Infection Control in Health Institutions of Minsk.* EpiNorth. 10(3), p.135-138.
11. Vogelaers D, De Bels D, Forêt F, Cran S, Gilbert E, Schoonheydt K, Blot S. (2010), Int J Antimicrob Agents. 35(4), p. 375-381.
12. Werarak P, Kiratisin P, Thamlikitkul V. (2010), *Hospital-acquired pneumonia and ventilator-associated pneumonia in adults at Siriraj Hospital: etiology, clinical outcomes, and impact of antimicrobial resistance.* J Med Assoc Thai. 93, p. 126-138.