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The Characteristics of Drug-Resistance of Bacteria Isolated from External Acoustic Meatus During Infections of the Middle Ear

Charakterystyka lekooporności bakterii izolowanych z przewodu słuchowego zewnętrznego w przebiegu zakażeń ucha środkowego

Apart from identification of species isolated during infections of the middle ear, an indispensable element to guarantee high effectiveness of antibiotic therapy is to determine the susceptibility of microorganisms to antibiotics. Due to extensive use of antibiotics and a common phenomenon of drug-resistance increase among bacteria, it is particularly important to determine the drug-resistance to chemotherapeutic agents (2—5).

During the past few years special attention was paid to the fact that apart from typically pathogenic species of bacteria, some other species, classified as opportunistic flora, may cause infections of the middle ear (1, 4, 5).

The aim of this work was a microbiological analysis of secretion from external acoustic meatus during infections of the middle ear and determination of drug-resistance of isolated bacteria as well.

MATERIAL AND METHODS

717 cases of bacteria origin infection of the middle ear were examined. Secretion from external acoustic meatus was tested by routine microbiological diagnostic methods. That means morphological and biochemical features of isolated species were examined. Later on, susceptibility to penicillin, ampicillin, cloxacillin, gentamycin, neomycin, erythromycin, cefradine, lincomycin, doxycyclin, negram, colistin and Biseptol (co-trimoxazol) were determined by the paper-disk-plate technique. The results were estimated by measuring the zones of inhibition surrounding the disks. The tests were performed in conformity with the procedure of disk producers.

Statistical analysis of appearance of marked species, their drug-resistance and joint presence in mixed infections was carried out according to differences among observed percentages.

RESULTS

Among isolated typical pathogens (Fig. 1), the largest percentage had *Staphylococcus aureus* (45%), the next were *Proteus vulgaris* (11) and *Pseudomonas aeruginosa* (9%).

Large percentages of diphteroid strains (26%) and *Staphylococci coagulase* — negative (*S. epidermidis* and *S. saprophiticus* — altogether 20%) confirm previous views about pathogenicity of strains classified till now, as physiological flora (1).

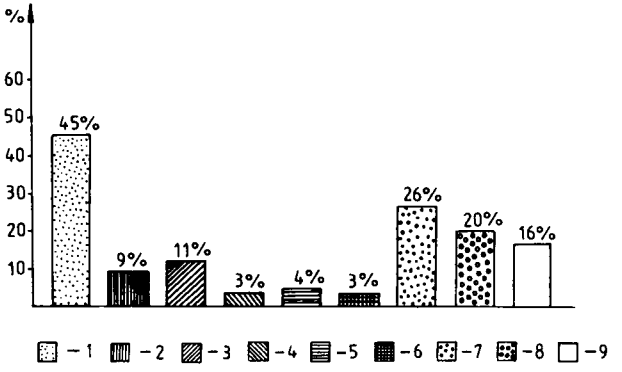

Fig. 1. The bacteria and *Candida albicans* isolated from external acoustic meatus during infections of middle ear; 1 — *Staphylococcus aureus*, 2 — *Pseudomonas auriginosa*, 3 — *Proteus vulgaris*, 4 — *Enterobacter aerogenes*, 5 — *Escherichia coli*, 6 — *Klebsiella* sp., 7 — *Diphteroid*, 8 — *Staphylococcus* cg-, 9 — *Candida albicans*

Cases of mixed infections of the middle ear are a large medical problem to treat, especially when opportunistic bacteria are found together with typical pathogens.

According to Table 1, showing commonly appearing species, it can be stated that, among mixed-type infections, *Staphylococcus aureus, Proteus vulgaris, Pseudomonas aeruginosa, E. coli* are found most often apart from diphteroids and staphylococci coagulase-negative.

Table 2 shows the drug resistance of isolated species. Strains resistant to penicillin, cloxacillin, ampicillin, lincomycin and cefradin made the largest percentage. Negram doxycyclin proved to be most effective (except for *Proteus vulgaris* and *Pseudomonas aeruginosa).*

An additional problem of antibiotic therapy in infections of the middle ear may be the presence of *Candida albicans* (16% of cases), which is also isolated in mixed infections (13%).

Table 1. The characteristics of commonly present species of bacteria (and *Candida albicans*) in mixed infections

Species of bacteria	*S. aureus* %	*Pseudomonas aeruginosa* %	*Proteus vulgaris* %	*Enterobacter aerogenes* %	*E. coli* %	*Klebsiella sp.* %	Diphteroids %	*Candida albicans* %	*Staphylococci cg-* %	Total %
S. aureus	—	7	10	3	5	2	21	13	9	70
Pseudomonas aeruginosa	7	—	—	—	0.3	—	1	2	3	133
Proteus vulgaris	10	—	—	1	2	—	4	2	4	23
Enterobacter aerogenes	3	0.3	1	—	1	—	2	2	1	103
E. coli	5	—	2	1	—	—	2	0.3	2	123
Klebsiella sp.	2	—	—	—	—	—	1	—	0.3	33
Diphteroids	21	1	4	2	2	1	—	6	19	56
Candida albicans	13	2	2	2	0.3	—	6	—	17	423
Staphylococci cg-	9	3	4	1	2	0.3	19	17	—	553

Table 2. Percentage of strains resistant to given antibiotics

Strains	Nr of cases	Penicillin %	Ampicillin %	Cloxacillin %	Gentamycin %	Neomycin %	Erythromycin %	Cefradine %	Lincomycin %	Negram %	Colistin %	Biseptol %	Doxycyclin %
S. aureus	322	75	59	59	12	16	39	32	41	—	—	64	47
Proteus vulgaris	81	88	75	98	7	37	86	81	100	44	58	71	93
Pseudomonas aeruginosa	62	100	97	97	5	31	82	98	100	66	11	85	84
E. coli	28	96	75	100	11	14	71	68	96	4	57	43	50
Enterobacter aerogenes	24	92	67	92	8	25	54	71	92	25	25	63	29
Klebsiella sp.	10	100	100	100	20	30	90	90	100	0	60	60	50

Conclusions

1. The above presented analysis of monoinfections and mixed infection of the middle ear shows that the most common species isolated from external acoustic meatus are: *Staphylococcus aureus, Proteus vulgaris, Pseudomonas aeruginosa* and *E. coli*. However, staphylococci coagulase-negative and diphteroid strains should not be considered only as additional saprophytic flora due to their high presence rate (20 and 26%, respectively).

2. The following antibiotics proved to be most effective in treatment of middle ear infections: doxycyclin, gentamycin, neomycin and negram as well.

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STRESZCZENIE

Badaniem objęto 717 przypadków z objawami bakteryjnego zakażenia ucha środkowego. Pobraną wydzielinę z zewnętrznego przewodu słuchowego poddano analizie mikrobiologicznej. Stwierdzono, że w monozakażeniach i zakażeniach mieszanych największy odsetek wśród izolowanych gatunków stanowiły: *S. aureus, Proteus vulgaris, Pseudomonas aeruginosa* i *E. coli.* Występujących również gronkowców koagulazo-ujemnych (20%) i szczepów dyfteroidalnych (26%) nie należy traktować tylko jako flory saprofitycznej.

Analizując oporność bakterii izolowanych z zewnętrznego przewodu słuchowego w przebiegu zakażenia ucha środkowego uznano za najbardziej skuteczne: negram, doksycyklinę, gentamycynę i neomycynę.