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Microbial landscape of surgical hospital

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Abstract
We have presented the results of the comparative analysis of microflora of the discharge of complicated wounds in patients and microbial landscape of washings from objects of environment of a surgical hospital. It has been established that in bacterial contamination of microflora of the discharge of complicated wounds, enterobacteria were found from objects of environment, it was non-fermenting Gram-negative bacteria. The main agents of purulent-septic infections at admission of patients were coliform bacillus, *Pseudomonas aeruginosa*, and *Staphylococcus* aureus. At repeated examination, the frequency of release of coliform bacillus decreased by 1.7 times, *P. aeruginosa*, on the contrary, increased by 1.5 times. From the objects of environment and from health workers, *P. aeruginosa*, *S. aureus*, and coliform bacillus were found. Frequency of detection of *P. aeruginosa* and *S. aureus* for 15-28 days increased by 1.1 times, the isolation rate of coliform bacillus, on the contrary, decreased by 1.5 times. With increase in the patients' length of stay in a hospital, the amount of the detected cultures of agents increases in associations, among which *P. aeruginosa*, *Escherichia coli* (*E. coli*), and *S. aureus* dominated. By the dismissal time from the hospital, the joined causative microorganism forced out the primary and allocated itself in a monoculture.

Keywords: Nosocomial infections (NI); purulent-septic infections (PSI); microbial landscape; surgical complications.

Introduction

Nosocomial infections represent one of the most important and burning issues of health care [1]. Modern scientific facts given in works of foreign and domestic researchers allow to claim that nosocomial infections (NI) arise, at least, in 5-10% of the patients coming to medical institutions [1-5].

The microbial landscape of each medical and preventive treatment facility is a result of set of difficult processes of interspecific relationship of micro and macroorganisms taking place in a special environment of a hospital taking into account influence of a set of aggressive factors of the environment (physical and chemical methods of disinfection, antibiotics) [6,7].

Talking about an etiology of hospital PSI, it is necessary to emphasize their polyetiology. The extensive list of agents includes representatives of various taxonomical groups relating to bacteria (aerobic and anaerobic bacteria), mycoplasmas, viruses, protozoa, and fungi [8,9]. Etiologic agents of PSI are opportunistic pathogenic microflora (OPM), vast majority of which is autoflora of a human body [9,10]. The biological range of agents is quite various and there is no uniform point of view concerning an etiologic role of various groups of microorganisms.

Objective of the research was to carry out comparative analysis of microflora of the discharge of complicated wounds in surgical patients and microbial landscape of washings from objects of environment of a surgical hospital.

Materials and Methods

Research of bacterial load was conducted by the standard methods in bacteriological laboratory of hospital. The material sampling from patients was carried out in the conditions of operating room or dressing room, and the rules of asepsis and immediate transfer of the material to laboratory were strictly followed. The air intake of the operational block, dressing room, wards and also washings from environment, surgical equipment,

tools, dressing material, hands, and clothes of the medical personnel were carried out. In view of that antibacterial therapy and sanitation of an operational wound, undoubtedly, the microbial landscape of the center of infection changes; whenever possible an intake of material was carried out before or during the operation in the course of treatment and before the dismissal.

Results and Discussion

The research of bacterial load of microflora of the discharge of wounds, objects of environment, carrier level of medical personnel are objective indicators of a course of epidemic process of purulent-septic infection in a surgical hospital. Bacteriological examination of the discharge of wounds, fistulas, drainage tubes, contents of abdominal cavity has been carried out in 66 patients with postoperative complications, and 223 strains of OPM were allocated. Laboratory research from objects of environment of a hospital, nasal cavity, pharynx, and hands of the medical personnel yielded positive result in 17.8% of cases. The range of agents included representatives of both aerobic and facultative anaerobic, and obligate anaerobe bacteria. The allocated microorganisms are presented in Figure 1.

When comparing microflora of the discharge of complicated wounds, washings from objects of environment of a surgical hospital and from health workers, it has been established that its qualitative structure did not differ. However, in percentage terms in a bacterial load of the discharge of complicated wounds enterobacteria (56.5% against 23.7% from objects) was found more often, while from objects of environment non-fermenting gram-negative bacteria (NFGB) were found more often (38.8% against 26.5% of patients). Gram-positive cocci in the discharge of wounds made 13.5% compared to 29.6% received from washings from subjects of environment and from health workers. Other microorganisms were detected in isolated cases, including representatives the nonclostridial anaerobic bacteria, serratia, yeast-like fungi, and aspergillus. The species composition of microflora of the discharge of complicated wounds in surgical patients was carried out in dynamics of treatment (Table 1).

The main agents of purulent-septic infection in patients at admission was coliform bacillus (40.8 ± 6.0%), then *P. aeruginosa* (23.7 ± 5.2%), *Enterobacter* was detected in 8.5 ± 3.4%, *Proteus* and *Klebsiella* in 6.2 ± 3.0% for each, respectively, *S. aureus* in 5.4 ± 2.8%. At repeated examination in the course of treatment, isolation rate of coliform bacillus decreased (28.7 ± 5.6% and 23.8 ± 5.2%, respectively). Frequency of allocation of *P. aeruginosa* increased by 1.5 times (34.9 ± 5.9%). It testifies to nosocomial infection of the discharge of complicated wounds, caused by *P. aeruginosa*.

For objective assessment of epidemiological situation in a surgical hospital microbiological research of washings from objects of environment, sterile, and dressing material, from hands, nasopharynx, and clothes of health

Figure 1: Microbial landscape of a surgical hospital.

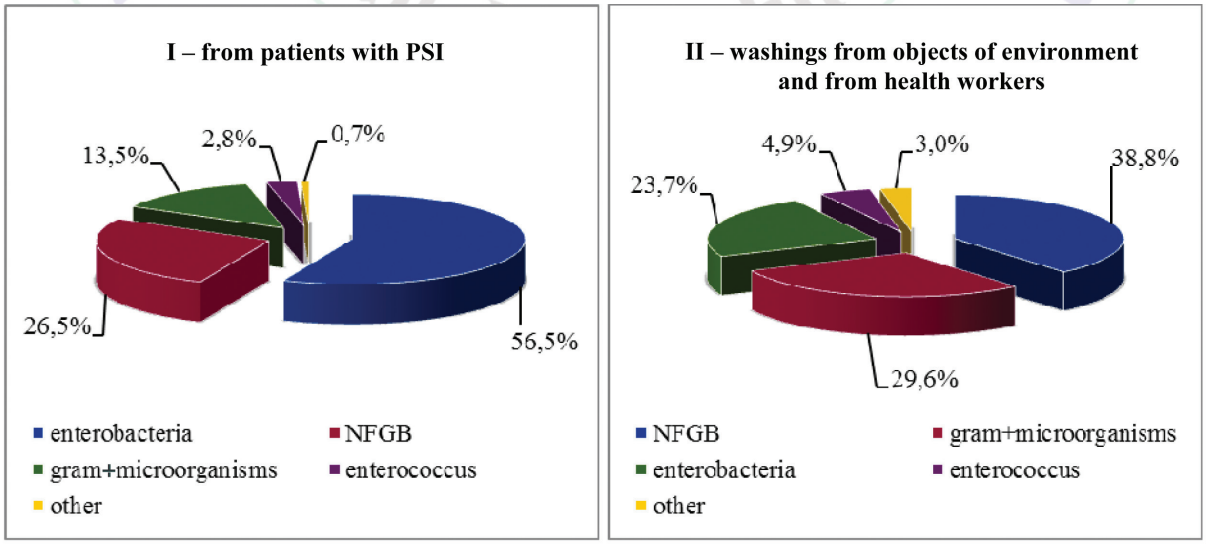

Table 1: Species composition of microflora of the discharge of complicated wounds in surgical patients in dynamics of treatment.

Microflora	Frequency of examination (66 patients)					
	1-7 days		8-14 days		15-28 days	
	Detection rate (%)	±m	Detection rate (%)	±m	Detection rate (%)	±m
E. coli	40.8	6.0	28.7	5.6	23.8	5.2
P. aeruginosa	23.7	5.2	34.9	5.9	34.9	5.9
Proteus	6.2	3.0	5.3	2.8	6.7	3.0
Klebsiella	6.2	3.0	6.2	3.0	7.1	3.1
Citrobacter	4.4	2.5	3.6	2.3	4.0	2.4
Enterobacter	8.5	3.4	4.0	2.4	4.4	2.5
S. aureus	5.4	2.8	8.5	3.4	7.1	3.1
S. epidermidis	1.3	1.4	2.2	1.8	1.8	1.6
Streptococcus	–	–	1.3	1.4	1.3	1.4
Enterococcus	2.2	1.8	1.8	1.6	1.8	1.6
Acinetobacter	–	–	1.3	1.4	3.1	2.1
Alcaligenes	–	–	1.3	1.4	2.7	1.9
Other	1.3	1.4	0.9	1.2	1.3	1.4

workers was conducted. In 82.2% of washings from subjects of environment of a hospital, growth of microorganisms was not noted, in 17.8% the microbial flora in monocultures was allocated. In the analysis of sterile, dressing, and sutural material the percent of unsterile tests made 0.6%. In tests of air from various offices of a surgical hospital in 6.2% of cases, growth of *S. aureus* was observed, Gram-negative microorganisms were not allocated in any of the tests were not found. Species composition of microflora of washings from objects of environment of a surgical hospital is shown in Table 2.

From objects of environment of a surgical hospital and from health workers *P. aeruginosa* (36.7 ± 2.2%), then *S. aureus* (27.5 ± 2.1%), coliform bacillus in 17.6 ± 1.8%, *Proteus* in 8.9 ± 1.3% were often found. Microbiological research in dynamics established that the isolation rate of *P. aeruginosa* increased (39.9 ± 2.3% and 40.2 ± 2.3%, respectively). Frequency of detection of *S. aureus* increased by 1.1 times (28.9 ± 2.1%). The isolation rate of coliform bacillus from objects of environment of a hospital, on the contrary, decreased by 1.5 times (from 17.6 ± 1.8% to 11.9 ± 1.5%).

Table 2: Dynamics of species composition of microflora from objects of environment and from the medical workers.

Microflora	Frequency of examination (66 patients)					
	1-7 days		8-14 days		15-28 days	
	Detection rate (%)	±m	Detection rate (%)	±m	Detection rate (%)	±m
E. coli	17.6	1.8	15.2	1.7	11.9	1.5
P. aeruginosa	36.7	2.2	39.9	2.3	40.2	2.3
Proteus	8.9	1.3	8.8	1.3	8.4	1.3
Klebsiella	3.8	0.9	3.1	0.8	1.9	0.6
Citrobacter	1.7	0.6	2.2	0.7	1.8	0.6
S. aureus	27.5	2.1	24.8	2.0	28.9	2.1
S. epidermidis	1.7	0.6	1.5	0.6	1.6	0.6
Enterococcus	1.0	0.5	–	–	0.8	0.4
Acinetobacter	–	–	1.8	0.6	2.3	0.7
Alcaligenes	0.4	0.3	1.1	0.5	0.7	0.4
Other	0.7	0.4	1.6	0.6	1.5	0.6

Different types of objects which were exposed to examination for bacterial load were colonized by microorganisms in different degree. On brushes for washing hands, hands of health workers, sinks, tap knobs, hoses, anesthesia-respiratory apparatus, tanks for soaking of dirty tools, *P. aeruginosa* (39.1%) and coliform bacillus (19.2%) were found most often. From underwear and bed linen, couches, dressing gowns, tools, soft and firm stock, wheelchairs, staphylococcus was found more often, in 26.5% cases.

Results of bacteriological tests from patients showed that at primary inspection and immediately after operation, from clinical material most often (69.5%) monocultures of microorganisms were allocated. Also *E. coli*, *P. aeruginosa*, *Enterobacter*, *Proteus*, *Klebsiella*, *S. aureus* were presented. Other microorganisms were found in insignificant quantities.

With increase in the patients' length of stay in a hospital, the amount of the found cultures of agents in association increases. By comparison of the allocated microorganisms from patients, it was noted that in association of microorganisms with the initially allocated agent the secondary joined, among which dominated in 30.2% cases *P. aeruginosa*, in 21.2% *E. coli*, and in 8.3% of *S. aureus*. By the dismissal time, the joined agent forced out the primary one, allocating in a monoculture. The number of the allocated microbial associations depending on the patients' length of stay in a hospital is shown in Table 3.

At the same time, increase of number of association of microorganisms was explained by a secondary bacterial load of the purulent center in the course of medical manipulations in clinical conditions. Further finding of patients was followed by increase of number of association from 13.4% in 1-7 days to 26.0% in 8-14 days, with two associations of microbes ($t = 3.4$; $p < 0.01$) and from 8.0% in 1-7 days to 12.1% in 8-14 days, with three associations of microbes. The quantity of the met microorganisms in a monoculture decreases from 69.5% to 57.8% by the time of dismissal. Frequency and structure of the met microbial associations allocated from patients is presented in Table 4.

From the data of Table 4, the fact attracts attention that the frequency of detection of Enterobacteriaceae associations with NFGB made 14.3%, Enterobacteriaceae with Enterobacteriaceae and NFGB with NFGB made 10.5%. Associations of two (made 63.8%) agents were found more often.

Table 3: Quantity of microbial associations depending on the patients' length of stay in a hospital.

Days	Monoculture		Associations of two microbes		Associations of three microbes		Associations of four and more microbes	
	%	Abs. number	%	Abs. number	%	Abs. number	%	Abs. number
1-7	69.5	155	13.4	15	8.0	6	9.1	5
8-14	51.1	114	26.0	29	12.1	9	10.8	6
15-28	57.8	118	22.5	23	11.8	8	7.8	4

Table 4: Frequency of seeding of associations depending on quantity of microorganisms.

Composition of microbial associations	Associations of two microbes		Associations of three microbes		Associations of four and more microbes	
	Abs. number	%	Abs. number	%	Abs. number	%
Enterobacteriaceae/NFGB	15	14.3	7	6.7	5	4.8
Enterobacteriaceae/Enterobacteriaceae	11	10.5	4	3.8	3	2.9
Enterobacteriaceae/*Staphylococcus*	6	5.7	3	2.9	2	1.9
Enterobacteriaceae/*Streptococcus*	4	3.8	2	1.9	1	1.0
NFGB/*Staphylococcus*	6	5.7	0	0	1	1.0
NFGB/NFGB	11	10.5	4	3.8	2	1.9
NFGB/*Enterococcus*	9	8.6	2	1.9	0	0
Staphylococcus/*Streptococcus*	5	4.8	1	1.0	1	1.0
Total	**67**	**63.8**	**23**	**21.9**	**15**	**14.3**

Conclusion

In a bacterial load of microflora of the discharge of complicated wounds in surgical patients, enterobacteria was found the most often (56.5%), while from objects of environment non-fermenting Gram-negative bacteria (38.8%) were found the most often.

The main agents of PSI in patients at admission were coliform bacillus (40.8 ± 6.0%), then *P. aeruginosa* (23.7 ± 5.2%), *S. aureus* was found in 5.4 ± 2.8%. At repeated examination in the course of treatment, the isolation rate of coliform bacillus decreased (28.7 ± 5.6% and 23.8 ± 5.2%, respectively). Frequency of allocation of *P. aeruginosa* increased by 1.5 times (8.5 ± 3.4%).

From objects of environment of a surgical hospital and from health workers, *P. aeruginosa* (36.7 ± 2.2%), then *S. aureus* (27.5 ± 2.1%), and coliform bacillus in 17.6 ± 1.8% were often found. Microbiological research in dynamics established that the isolation rate of *P. aeruginosa* increased (39.9 ± 2.3% and 40.2 ± 2.3% respectively). Frequency of detection of *S. aureus* increased by 1.1 times (28.9 ± 2.1%). The isolation rate of coliform bacillus from objects of environment of a hospital, on the contrary, decreased by 1.5 times (from 17.6 ± 1.8% to 11.9 ± 1.5%).

With increase in the patients' length of stay in a hospital, the amount of the found cultures of agents increases in associations, among which in 30.2% cases dominated *P. aeruginosa*, in 21.2% – *E. coli* and in 8.3% – *S. aureus*. By the time of the dismissal the joined agent forced out the primary agent and was allocated in a monoculture.

References

1. Smith RL, Bohl JK, McElearney ST, Friel CM, Barclay MM, *et al*. (2004) Wound infection after elective colorectal resection. Annals of Surgery 239(5): 599-607.

2. Abashina VL, Evdokimova LP, Homichuk TF, Semeykina LM (2014) Epidemiological features of nosocomial infection in Primorsky Krai. Health Medical Ecology Science 4(58): 114-118.

3. Andreyeva TA, Bazhazhina NA (2012) Problem of nosocomial infections in obstetric facilities of Tula region. Infection and Immunity 2(1-2): 470-471.

4. Hautemaniere A, Florentin A, Hunter PR, Bresler L, Hartemann P (2013) Screening for surgical nosocomial infections by crossing databases. Journal of Infection and Public Health 6(2): 89-97.

5. Rosenthal VD, Maki DG, Salomao R, Moreno CA, Mehta Y, *et al.* (2006) Device-associated nosocomial infections in 55 intensive care units of 8 developing countries. Annals of Internal Medicine 145(8): 582-591.

6. Dantas SR, Kuboyama RH, Mazzali M, Moretti ML (2006) Nosocomial infections in renal transplant patients: risk factors and treatment implications associated with urinary tract and surgical site infections. Journal of Hospital Infection 63(2): 117-123.

7. Weinstein RA (2005) Overview of nosocomial infections caused by Gram-negative bacilli. Clinical Infectious Diseases 41(6): 848-854.

8. Belsky DV, Rudnov VA, Cherkasov GV, Yazov OA (2012) Influence of measures of infection control on prevalence of hospital infections in departments of neurosurgical reanimation of Yekaterinburg. Ural Medical Magazine 93(1): 15-22.

9. Pokrovsky VI, Akimkin VG, Briko NI, Brusina EB, Zuyeva LP, *et al.* (2011) Nosocomial infections: new horizons of prevention. Epidemiology and Infectious Diseases 1: 4-7.

10. Gavrilova KP, Fedorov VE (2013) The analysis of the reasons of postoperative complications in the emergency surgical practice. Bulletin of Medical Internet Conferences 3(3): 810.