

PARTICULARITIES OF THE ETIOLOGICAL STRUCTURE OF NOSOCOMIAL INFECTIONS IN HOSPITALS OF ORTHOPEDICS AND TRAUMATOLOGY PROFILE

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PARTICULARITIES OF THE ETIOLOGICAL STRUCTURE OF NOSOCOMIAL INFECTIONS IN HOSPITALS OF ORTHOPEDICS AND TRAUMATOLOGY PROFILE (Abstract): Determination of etiological structure of septic-purulent nosocomial infections (SPNI) in hospitals of orthopedics and traumatology profile. **Materials and methods:** there were analyzed 2013 strains of microorganisms isolated from the patients with SPNI. **Results:** it was established that Gram-positive microorganisms (63.19%) prevail in hospitals of Orthopedics and Traumatology profile, including *S. aureus* (39.19%), *E. faecalis* (12.76%), *S. epidermidis* (10.13%), followed by Gram negative microorganisms (35.56%), including *P. aeruginosa* (10.68%), *E. aerogenes* (8.64%), *E. coli* (4.32%), *C. diversus* (4.37%), *P. vulgaris* (2.58%), *Kl. pneumoniae* (1.54%). It was found that Gram positive strains prevail in young population, but Gram negative bacteria and fungi prevail in old population. Also, it has been shown that pathologic foci with associations of microorganisms predominate among old population, while monocultures prevail among young population. During the last years, it was observed an increase of SPNI caused by associations of microorganisms. **Conclusions:** The septic-purulent pathology has a polyetiological character in hospitals of orthopedics and traumatology profile, both in general population, as well in the hospital outbreaks among patients. **Keywords:** SEPTIC-PURULENT, NOSOCOMIAL INFECTIONS, GRAM-POSITIVE, GRAM-NEGATIVE, ETIOLOGICAL STRUCTURE.

Septic-Purulent Nosocomial Infections (SPNI) is one of the main problems of contemporary medicine (1, 2, 3), being caused by a variety of microorganisms. Thus, studying the etiological peculiarities per stationary profile, by age, methods of treatment is an important element in the epidemiological surveillance system (3-11). Also, the increase of frequency of association of two or more causative agents in the development of SPNI was underlined (1). The peculiarities of etiological structure of SPNI

patients of orthopedics and traumatology profile are determined in the current study.

MATERIAL AND METHODS

This research is a descriptive transversal epidemiological study based on retrospective analysis of 2013 strains, a result from microbiological investigations performed in bacteriological laboratory of Traumatology and Orthopedics Clinical Hospital during years 2009-2010 and 2013-2014. The identification of microorganisms

**Particularities of the etiological structure of nosocomial infections
in hospitals of orthopedics and traumatology profile**

in SPNI was performed per classical methods (Galețchi 1997, Buiuc 1999), collecting the material from the wound was carried out using the moistened in physiological solution (0.9%) buffer.

RESULTS

The study of those 2013 strains of microorganisms, emphasized that the etiological structure of the traumatological septic-purulent infections (SPI) includes 18 species of microorganisms, the majority are opportunistic bacteria (tab. I). The Gram-positive microorganisms prevail, which is (63.2%). The causative agents in trauma

SPI were represented by *S. aureus*-62.02%, *S. epidermidis*-15.02% and *S. saprophyticus*-1.10%. *Enterococcus* is 21.86%, prevailed *E. faecalis*-20.20%, followed by *E. faecium*-1.5% and *S. pyogenes*-0.07%.

Gram negative microorganisms group constituted 35.56% of the total number of strains detected from the patients with trauma SPI. *P. aeruginosa*-30.02%, and *E. aerogenes*-24.3%, followed by *E. coli*-12.30% prevailed. Microorganisms of the *Citrobacter* genus -17.59%, *Proteus*-10.06% and *Klebsiella*-5.30%. From 25 patients with SPI with infected wounds were isolated- *C. albicans* (1.24%).

TABLE I
**The structure of microorganisms isolated from the patients with SPI
in hospitals of orthopedics and traumatology profile**

Groups	Microorganism species	Number of strains	% from the group	% of total strains
Gram-positive Microorganisms	<i>Staphylococcus aureus</i>	789	62.02	39.19
	<i>Staphylococcus epidermidis</i>	191	15.02	9.49
	<i>Staphylococcus saprophyticus</i>	14	1.10	0.69
	<i>Enterococcus faecalis</i>	257	20.20	12.76
	<i>Enterococcus aecium</i>	20	1.57	1.0
	<i>Streptococcus pyogenes</i>	1	0.07	0.05
	Total Gram positive	1,272	100.0	63.20
Gram-negative Microorganisms	<i>Escherichia coli</i>	88	12.3	4.40
	<i>Enterobacter aerogenes</i>	174	24.3	8.64
	<i>Enterobacter cloacae</i>	1	0.14	0.05
	<i>Klebsiella pneumoniae</i>	31	4.33	1.54
	<i>Klebsiella oxytoca</i>	7	0.97	0.35
	<i>Pseudomonas aeruginosa</i>	215	30.02	10.68
	<i>Proteus vulgaris</i>	52	7.26	2.58
	<i>Proteus mirabilis</i>	20	2.80	1.0
	<i>Citrobacter freundii</i>	39	5.44	1.89
	<i>Citrobacter diversus</i>	87	12.15	4.32
	<i>Klebsiella oxytoca</i>	7	0.97	0.35
	<i>Acinetobacter calcoaceticus</i>	2	0.28	0.1
	Total Gram negative	716	100.0	35.56
	Fungi	<i>Candida albicans</i>	25	100.0
TOTAL		2,013	100.0	100.0

The distribution of the isolated strains taking into consideration the occupied rank in the total clinical picture (tab. I) demonstrates that in the general etiological structure of SPNI in hospitals of orthopedics and traumatology profile is as it follows: on the first place are the microorganisms of the *Staphylococcus* genus (*S. aureus*-39.19% and *S. epidermidis*-12.76%), followed by *P. aeruginosa*-10.61%, *E. faecalis*-9.49%, *E. aerogenes*-8.64%, *E.coli*-4.40%, *C. diversus*-4.32%, *P. vulgaris*-

2.58%, *C. freundii*-1.89%, *Kl. pneumoniae*-1.54%, other microorganisms-3.46%.

There are 8 species of microorganisms that prevail in mixt infections, including the Gram-positive ones: *S. aureus*-in 31.52% cases of infections, *S. epidermidis*-5.35%, *E. faecalis*-19.48%; from the Gram-negative microorganisms *P. aeruginosa* in 10.86%, *E. aerogenes*-10.25%, *E. coli*-5.04%, *Citrobacter*-7.35%, *Proteus*-5.04%, *Klebsiella*-2.01%; other microorganisms 2.87% (fig. 1).

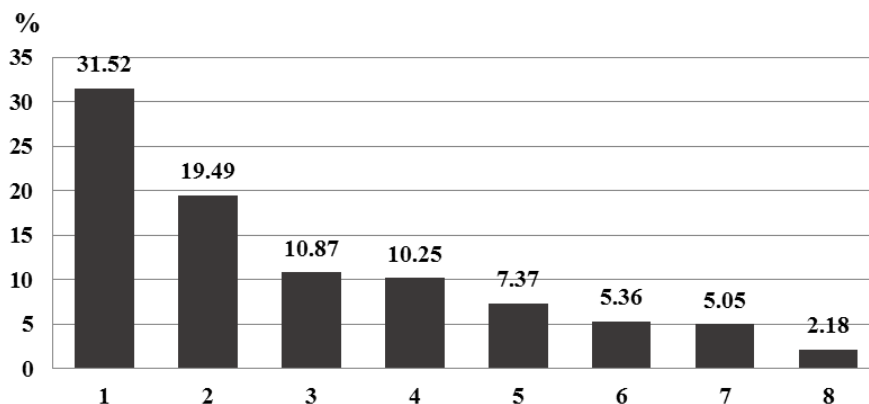


Fig. 1. The species of microorganisms prevalent in associations of pathogens according to the occupied rank: 1- *S.aureus*; 2- *E. faecalis*; 3- *P. aeruginosa*; 4- *E. aerogenes*; 5- *Citrobacter*; 6- *S.epidermidis*; 7- *E.coli* and *Proteus*; 8- *Klebsiella*

Peculiarities in the structure of microorganisms in relation with the patients' age. It has been found that Gram-positive microorganisms prevail among young age groups, the share part of which diminishes with age, from 74.68% in people up to 20 years, up to 55.17% in 70 years and older persons. And vice versa, Gram negative microorganisms and fungi prevail in the old age groups, with an increasing rate from 25.3% and 0.0%, respectively, among patients under the age of 20 years, up to 42.67% and 2.15% respectively, among patients aged 70 years and older (tab. II).

At same time, it has been found that the number of isolated strains from pathological foci varies and is in direct relation to the age of patients (tab. III, fig. 2). Thus, monocultures were isolated from pathological foci in young patients, while the associations from 2-5 strains of microorganisms in elderly. This phenomenon is demonstrated both by the growing share of associations of microorganisms, detected in patients with SPNI according to the age, and by calculating to 1,000 patients in each age category. One strain was isolated predominantly in patients aged 16-39 years that is

**Particularities of the etiological structure of nosocomial infections
in hospitals of orthopedics and traumatology profile**

1303,7 per 1000 patients. While associations from 2-5 strains are prevalent in patients over 40 years and more-1648,3 strains per 1,000 patients, the statistics difference being confirmed ($t=3.95$, $p<0.001$).

The analysis of evolutionary changes in the structure of monocultures and associations of microorganisms. It is interesting both the epidemiological and clinical evolution of the number of strains isolated

from patients with SPNI-in associations or monocultures. During years 2009-2010 and 2013-2014, 2013 respectively 1,857 strains of microorganisms from 1,280 and 1,089 patients respectively were isolated, the average number of isolate strains from a patient being 1.57 and 1.71 respectively some foci, which demonstrates the increased number of patients with SPNI affected by associations of microorganisms (tab. IV).

TABLE II
**The structure of microorganisms isolated from the patients with SPI,
per the patients' age**

The group of microorganisms	Indices	Age category (years)						
		≤20	20-29	30-39	40-49	50-59	60-69	≥70
Gram positive	No.	59	156	205	207	315	202	128
	%	74.68	67.82	65.70	64.68	62.25	60.29	55.17
Gram negative	No.	20	74	104	117	185	127	99
	%	25.3	32.17	33.33	36.67	36.56	37.91	42.67
Fungi	No.	-	-	3	5	6	6	5
	%	0.0	0.0	0.96	1.56	1.18	1.79	2.15
Total	No.	79	230	312	320	506	335	231
	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE III
**Frequency of strains number isolated from pathological foci
according to the age of patients**

Number of strains	Indices	Age category (years)						
		≤20	20-29	30-39	40-49	50-59	60-69	≥70
1 strain	No.	48	108	114	110	150	130	66
	%	716.40	620.68	609.62	582.01	474.68	610.32	485.07
2 strains	No.	8	40	54	67	112	70	39
	%	238.80	459.77	346.15	708.99	708.86	657.27	582.08
3 strains	No.	5	14	27	21	40	19	27
	%	223.88	241.37	433.15	333.33	379.74	267.60	604.47
4-5 strains	No.	-	-	2	2	3	3	2
	%	-	-	21.39	63.49	37.97	37.55	59.70
Total patients	No.	61	162	197	200	305	222	134
	%	1,179.1	1,321.8	1,668.4	1,693.1	1,601.2	1,572.7	1,723.8

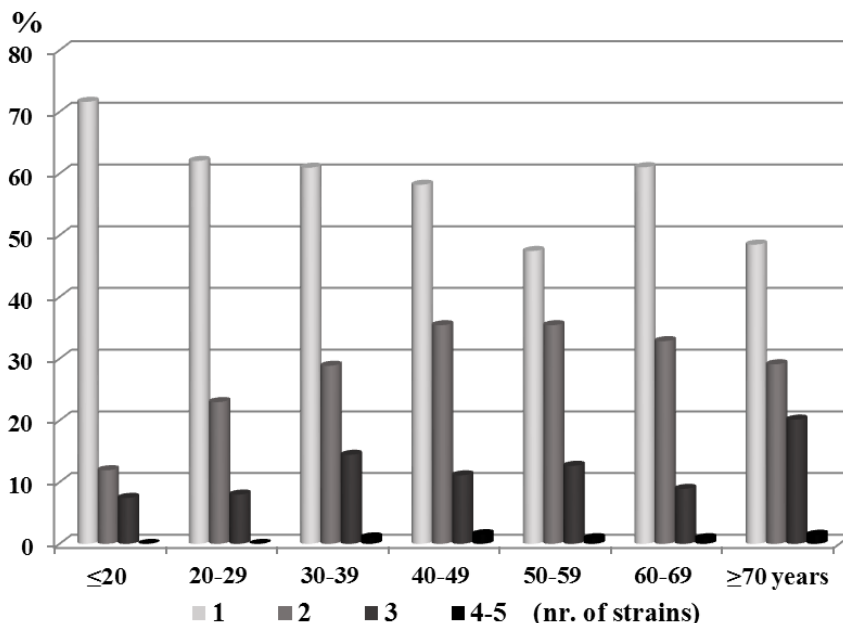


Fig. 2. Strains' number distribution isolated from pathologic foci according to the age of patients

TABLE IV

Distribution of cases of traumatology SPI according to the number of strains isolated from the pathologic focus

Periods	Indices		Number of strains of microorganisms detected in patients with SPNI					Total
			1	2	3	4	5	
Years 2009-2010	No. of patients	Abs.	725	390	153	11	1	1,280
		%	56.64	30.47	11.95	0.86	0.78	100.0
	No. of strains	Abs.	725	780	459	44	5	2,013
		%	36.01	38.74	22.80	2.2	0.25	100.0
Years 2013-2014	No. of patients	Abs.	526	372	178	12	1	1,089
		%	48.30	34.16	16.35	1.10	0.09	100.0
	No. of strains	Abs.	526	744	534	48	5	1,857
		%	28.33	40.06	28.76	2.58	0.27	100.0

It was emphasized that the mono-etiological nature of septic-purulent infections foci, in the multiannual dynamics, is decreasing from 56.64% of investigated patients or 36.01% of isolated strains-between 2009-2010, up to 48.30 % of pa-

tients or 28.33% of detected strains-in 2013-2014, being confirmed the statistical difference ($t=2.89, p<0.01$). And vice versa, we found an increase of polyetiological aspect. There were isolated from 2 to 5 septic-purulent strains 43.36% of those

**Particularities of the etiological structure of nosocomial infections
in hospitals of orthopedics and traumatology profile**

investigated, that is 63.99% of all the isolate ones. During the next period, 2013-2014, there were found associations of 2-5 strains of microorganisms in 51.70% of the investigated ones with septic-purulent infections, being 71.67% of the total number

of strains (tab. IV, fig. 3).

The number of patients with associations of microorganisms increased by 8.34% in multi-annual dynamics, but the number of microorganisms isolated in associations increased by 7.68%.

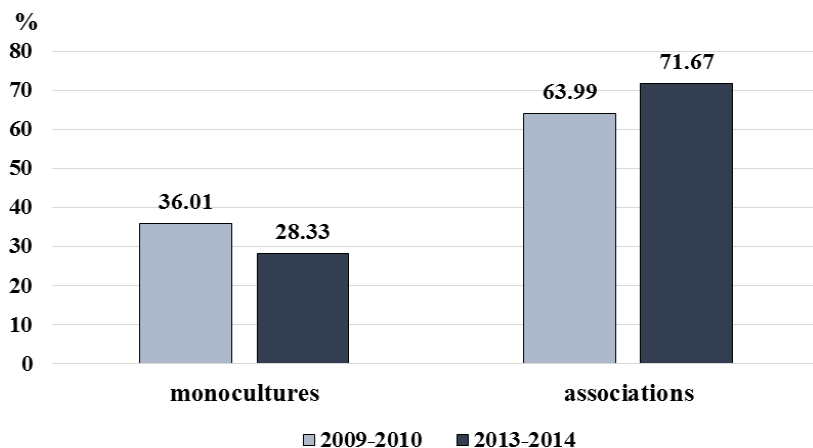


Fig. 3. The distribution of patients with SPI in hospitals of ortopedopedic and trauma profile with monocultures and associations of microorganisms

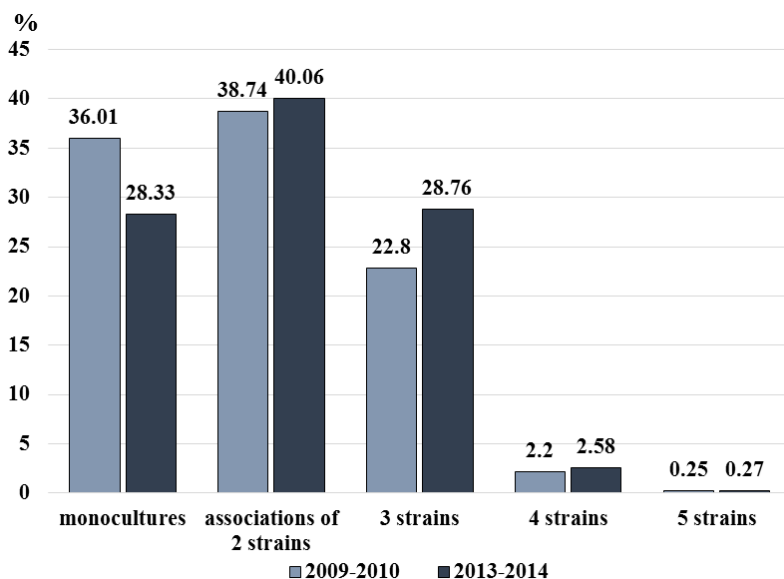


Fig. 4. Comparative distribution of SPI cases according to the number of strains isolated from the pathologic focus, over periods

Therefore, from the total number of isolated strains 63.99% (years 2009-2010) and 71.67% were proven to be in various associations ($t=2.75$, $p<0.01$), including 38.74% and respectively 40.06%-associations of two species-1.32% more in the second period; 22.80% and respectively 28.75%-associations from three species-increasing by 5.95% compared to the previous stage; 2.2% and 2.58% respectively-associations from four species-growing by 0.38%; and 0.25% and respectively 0.27%-associations from five species (tab. IV, fig.4).

CONCLUSIONS

Our researches showed that the septic-purulent pathology in hospitals of orthope-

edics and traumatology profile has a polyetiological character, both in general, and in the infectious foci in patients. The Gram-positive microorganisms prevail (63.19%) compared to Gram-negative ones (35.56%).

We have established that the SPNI are caused mainly by monocultures and Gram-positive bacteria in patients of young age, while SPNI with Gram-negative, fungi and associations with 2-5 strains, prevail in old age.

We have determined that the rate of patients with monocultures decreases in multi-annual dynamics and, *vice versa*, we have registered an increasement of cases caused by the associations of multiple microorganisms.

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