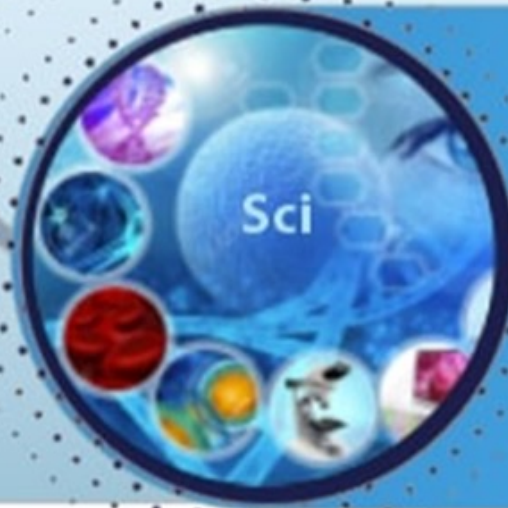




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The Main Etiological Agents of Suppuration of Postoperative Wounds

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ABSTRACT

Background. Determination of the microbial composition of the surgical wound, molecular genetic characteristics of the main contaminant strains, antibiotic resistance of microflora, and justification of rational antibiotic therapy of infections in the field of surgical intervention today is a very urgent problem of surgery.

Material. The wound discharge of 248 patients operated on in the clinic of the Tashkent Medical Academy for the period from 2015 to 2020 was studied. All operations were divided into a class of surgical wounds.

Results. Microorganisms isolated from surgical wounds belong to the group of episodically occurring or random. The group of the main microflora consists of *S. epidermidis*, and *E. coli* with the advantage of isolating *S. epidermidis* in the obstetric and gynaecological department, and *E. coli* in the surgical department.

Conclusion. The microbiocenosis of the surgical wound is characterized by an increase in the richness of species, which serves as a compensatory mechanism for a low rate of constancy. These microorganisms have the highest indicator of significance, depending on the class of wounds, an increase in the dynamics of specific gravity in monoforms and associations.

Keywords: Postoperative wound, wound suppuration, wound microflora

INTRODUCTION

Almost any wound, even if inflicted in an operating room, contains a certain number of microbes, including those capable of causing postoperative infection, defined as a clinically recognizable infectious complication [1, 8, 12].

The long-term dynamics of infections in the field of surgical intervention have not been studied anywhere due to the lack of objective data on their frequency,

therefore, the study of the microbial composition of the surgical wound is one of the stages in solving this problem [7, 13, 29].

The assessment of the microbial factor in the development of wound infection has always been given great attention. Undoubtedly, the type and number of microorganisms and their pathogenic properties play a significant role in the development of purulent

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inflammatory complications and largely determine the nature of their course [2-22].

At present, it has been proven that the infectious process in the wound can be caused by microflora of varying degrees of pathogenicity [3-21].

Massive antibiotic therapy, carried out without taking into account the nature of the pathogen, suppresses the normal microflora, facilitating the living conditions of antibiotic-resistant microbes [16].

Along with this, in microbes-causative agents of the pathological process, there is an acceleration of modification towards the appearance and enhancement of pathogenic properties [29].

Since the species diversity of microorganisms is increasing, and their pathogenic properties and resistance to antimicrobial drugs are increasing, the issues of studying the microbial aspect and its effect on the pathogenesis, clinic and treatment of suppurative complications of the wound, improving diagnostics, searching for new effective antimicrobial drugs are relevant, which determined the choice of the purpose and main objectives of this study.

MATERIAL AND METHODS

The microbial composition of surgical wounds was studied in groups of surgical patients who underwent surgery in the period from 2015 to 2020 with positive seeding from surgical wounds. 4 groups (248 people) were formed, distinguished by the class of surgical wounds (operations): Class I - "clean" - 15 people, Class II - "conditionally clean" - 101 people, Class III - "contaminated" - 70 people, Class IV - "dirty" - 62 people. Patients who have undergone operations of I, III and IV classes are patients of the surgical department, and patients who have undergone operations of class II - obstetric and gynaecological departments.

The material for microbiological analysis was 1596 biological samples of discharge of surgical wounds from 861 patients, 67 samples of discharge of postoperative wounds, 152 samples of deep auto microflora of the skin and 1663 smear-imprints of the wound surface of surgical patients.

118 air samples and 783 washes from surfaces were selected for research. Comparative biological properties and associated forms were studied in 372 strains of microorganisms isolated from surgical patients during surgery. 46 strains isolated from postoperative wounds, 164 strains of deep auto microflora of the skin, 66 strains from the external environment and 44 strains from the mucous membranes of the upper respiratory tract of

medical personnel. 626 molecular genetic studies were carried out by RT-PCR with the detection of eight markers of pathogenicity factors and one methicillin resistance.

Statistical analysis of the studies was carried out using the method of univariate descriptive statistics using the program "Statistica 6.0" (arithmetic mean M , its error t , Student's criterion - t , significance level - p), correlation analysis using the rank correlation coefficient.

RESULTS

During the bacteriological examination of the discharge of surgical wounds, 372 strains were isolated and identified, among which aerobic microorganisms (98.4±0.6%) prevailed - 366 pieces.

The share of anaerobic flora accounted for 6 strains (1.6±0.6%). The spectrum of aerobic microflora was formed by 53 species and 18 genera, the number of anaerobes included 5 species of bacteria assigned to 3 genera.

The most frequent representatives of the microflora of surgical wounds were gram-positive coccal forms, the proportion of which was 56.5±2.6% (210 strains) and gram-negative bacilli - 39.2±2.5% (146 strains). Other microorganisms: gram-negative cocci, gram-positive rods, and yeast-like fungi were isolated with a specific gravity of 0.3±0.3%, 1.9±0.7%, and 0.5±0.4%, respectively.

The species composition of individual groups of microorganisms of surgical wounds was studied by us in dynamics. In the general spectrum of microorganisms all the years, the leading place was occupied by gram-positive cocci in the range of 48.6±8.4% - 64.3±7.4%. The proportion of gram-negative bacilli was slightly lower and ranged from 30.9±7.1% to 48.6±8.4%.

In the early years of the study, the participation of gram-positive cocci and gram-negative bacilli was unambiguous (48.6±8.4% each). All other microorganisms were isolated in isolated cases.

Gram-positive coccal flora was represented by two families of micrococci (55.1±2.6%) and streptococci (1.4±0.6%). A distinctive feature of the first was the diversity of species, the multiplicity of strains and the large number of isolated cultures. The number of representatives of the genus *Staphylococcus* included 14 species, of which 12 species were classified as coagulase-negative, and 2 species as coagulase-positive staphylococci. At the same time, both of them in the total

ratio amounted to $87.3 \pm 2.8\%$ (124 strains) and $12.7 \pm 2.8\%$ (18 strains), respectively.

The proportion of micrococci among all isolated microorganisms ranged from $4.8 \pm 2.1\%$ to $29.1 \pm 6.6\%$ with a leading position in subsequent years.

The proportion of seeding of micrococci increased in the first two years of the study from $23.8 \pm 6.6\%$ to $29.1 \pm 6.6\%$, respectively, and in subsequent years decreased to $15.6 \pm 4.5\%$ and $5.9 \pm 2.9\%$.

Thus, there was a statistically significant decrease in the proportion of micrococci in the total spectrum of microorganisms of the surgical wound during the study period by 4.7 times ($p < 0.001$). The family Streptococcaceae was represented by two genera (Streptococcus, Enterococcus) and three species (S. milleri, E. faecium, E. faecalis), isolated in isolated cases, which ranged from $1.6 \pm 1.6\%$ to $5.7 \pm 3.9\%$.

In the group of gram-negative bacilli, enterobacteria with a specific gravity of $20.8 \pm 5.9\%$ to $48.6 \pm 8.4\%$ and non-fermenting gram-negative bacteria (from $10.4 \pm 4.4\%$ to 4.8 ± 2.1) were isolated. Among enterobacteria, E. coli is the most common - $64.5 \pm 4.3\%$ (78 strains in total over the years). The proportion of E. coli in different years ranged from $37.5 \pm 10.1\%$ to $100 \pm 0.0\%$ with some downward trend. The proportion of non-fermenting gram-negative bacteria in the overall structure of microorganisms remained almost unchanged over time and included A. hvoffii $48 \pm 10.2\%$ (12 strains), and P. aeruginosa - $20.8 \pm 8.2\%$ (5 strains). A. junii and A. piechaudii $12 \pm 6.6\%$ each (3 strains). A. faecalis and P. putida $4.0 \pm 4.0\%$ each.

Analysis of the total frequency of occurrence of individual microbial species in the study period showed that the leading place among them was occupied by 2 representatives: E. coli ($21.0 \pm 3.1\%$) and S. epidermidis ($15.3 \pm 2.7\%$). They together accounted for $36.3 \pm 3.6\%$ and are included in the main group of bacteria. Other, rare species, in aggregate, accounted for $47.6 \pm 3.8\%$, the proportion of each of them ranged from $1.1 \pm 0.8\%$ to $6.7 \pm 1.9\%$.

Rare findings were: other representatives of staphylococci 22.8 ± 3.1 , enterobacteria - $8.3 \pm 2.1\%$, non-fermenting gram-negative bacteria $4.6 \pm 1.6\%$. The rest of the microflora (60 species) was isolated in the form of single cultures, the aggregate of which was $16.1 \pm 1.9\%$ and was assigned by us to the group of episodically occurring microorganisms.

When studying the microbiocenosis of surgical wounds in groups of patients who underwent operations on the profile of surgical, gynaecological and obstetric

divisions, it was found that the proportion of representatives of the main microflora increased from $30.4 \pm 9.8\%$ (with class I operations) to $25.6 \pm 3.6\%$ (with class II operations), $47.3 \pm 5.1\%$ with class III and $42.1 \pm 4.7\%$ with class IV operations. Moreover, the proportion of S. epidermidis decreased with an increase in class from $30.4 \pm 9.8\%$ in I to $22.8 \pm 3.5\%$ in II, $7.3 \pm 2.7\%$ and $9.1 \pm 2.8\%$ III and IV, respectively. E. coli in class I was not detected, in class II it was $2.8 \pm 1.4\%$, in classes III and IV it was found with a specific gravity of up to $40.0 \pm 5.03\%$ and $33.0 \pm 4.5\%$, respectively.

In general, according to the sum of isolated microorganisms, the microflora of CW is characterized by a predominance of E. coli $32.6 \pm 3.1\%$, wound microflora - S. epidermidis - ($28.6 \pm 8.7\%$ and $21.4 \pm 3.8\%$, respectively).

Of the 61 microorganisms found in the associations during the study period, in 11 cases (18.0%) the obligatory microorganism was S. epidermidis and in 8 - E. coli (13.1%). In general, staphylococci accounted for 40.9% and enterobacteria 26.2%. Micrococci and non-fermenting gram-negative bacteria accounted for 13.1% each, corynebacteria and yeast-like fungi, which occurred in isolated cases - 4.9% and 1.6%, respectively.

Statistically significant differences were recorded between the groups of staphylococci isolated from surgical and postoperative wounds ($p < 0.05$). Among staphylococci, the leading place was occupied by S. epidermidis $26.1 \pm 6.5\%$ versus $10.5 \pm 2.0\%$ in surgical wounds ($p < 0.05$). The second place after staphylococci in the aetiology of the postoperative wound was occupied by enterobacteria - $17.4 \pm 5.6\%$, which is 2.7 times less than the share of their participation in the aetiology of the surgical wound ($p < 0.05$). Among Enterobacteriaceae, E. coli also prevailed ($8.7 \pm 4.1\%$) versus $32.6 \pm 3.1\%$ in surgical wounds ($p < 0.05$).

Analysis of the total etiological significance of individual microbial species in the postoperative wound showed that representatives of coccal microflora, namely staphylococci, were of primary importance, together amounting to $67.4 \pm 6.9\%$.

DISCUSSION

The microbiocenotic analysis of the microlandscape of the surgical wound using the following indicators: the incidence index, the significance index, and the species diversity indicator showed that, despite the increase in the richness of species in dynamics, all isolated microorganisms are assigned to the group of episodically occurring or random, (constancy index - $C < 25\%$), since the surgical

wound is not inherently a biotope of the human body with the presence of permanent inhabitants. The highest permanence index was in the group of gram-positive cocci (13%), including; in the genus *Staphylococcus* 9.5%, gram-negative rods 9%, and family Enterobacteriaceae including 7.6%. Other groups and genera were found with even lower frequency [12].

The significance of microorganisms was assessed by taking into account the class of wounds in the main groups (II, III, IV). The most significant in the II class of wounds (operations) were the bacteria *Staphylococcus* spp., their significance index was 24.5%. *E. coli* bacteria were most significant in class III with an index of 23.5%, staphylococci and other enterobacteria - in class IV of wounds (operations) (16.2% and 18%, respectively). Microorganisms *Micrococcus* spp., *Acinetobacter* spp., *Alcaligenes* spp., and *B. mesentericus* had low significance indices [22].

In dynamics, there was an increase in the qualitative indicator of species richness to 0.0026%, which served as a compensatory mechanism for a low indicator of their constancy, and then there was a decrease in species diversity as a measure to compensate for the growth of pathogenic properties of the remaining species.

CONCLUSION

Bacteriological examination of the discharge of 67 postoperative wounds of patients of the surgical department revealed 46 microorganisms in 57% of the samples. The microflora of the postoperative wound was represented by 18 species and 9 genera versus 40 species from 20 genera of the surgical wound.

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Consent for publication - The study is valid, and recognition by the organisation is not required. The authors agree to open the publication.

Availability of data and material - Available

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**OPERATSIYADAN SO'NGGI YARALARNI
YIRINGLASHI ASOSIY ETIOLOGIK
AGENTLARI
Kasimov U.K.
Toshkent tibbiyot akademiyasi
ABSTRAKT**

Dolzarbligi. Jarrohlik yarasining mikroba tarkibini aniqlash, asosiy mog'or shtammlarining molekulyar genetik xususiyatlari, mikrofloraning antibiotiklarga chidamliligi, jarrohlik aralashuvi sohasida infeksiyalarning ratsional antibiotik terapiyasini oqlash bugungi kunda jarrohlik amaliyotining juda dolzarb muammosi hisoblanadi.

Material. Toshkent tibbiyot akademiyasi klinikasida 2015 yildan 2020 yilga qadar bo'lgan davr uchun operatsiya qilingan 248 nafar bemorning yara tashxisi o'rganildi. Barcha operatsiyalar xirurgik yaralar sinfiga bo'lindi.

Natijalar. Xirurgik yaralardan ajratib olingan mikroorganizmlar epizodik yoki tasodifiy ravishda sodir bo'lgan guruhga mansub. Asosiy mikrofloralar guruhida *S. epidermidis*, *E. coli*, umurtqali va ginekologik bo'limda *S. epidermidis*ni, xirurgik bo'limda *E. coli* ajratib olish afzalligi bilan tarkib topgan.

Xulosa. Xirurgik yaraning mikrobiosenozi turlarning boyligi oshishi bilan xarakterlanadi, bu ularning barqarorligi past ko'rsatkichlari uchun kompensatsion mexanizm bo'lib xizmat qiladi. Bu mikroorganizmlar yaralar sinfiga qarab eng yuqori ahamiyatga ega ko'rsatkichga ega, monoform va assotsiatsiyalarda aniq gravitatsiya dinamikasining ko'payishi.

Tayanch iboralar: operatsiyadan so'nggi yirinlagan yara, yara yiringlashi, yara mikroflorasi

**ОСНОВНЫЕ ЭТИОЛОГИЧЕСКИЕ АГЕНТЫ
НАГНОЕНИЯ ПОСЛЕОПЕРАЦИОННЫХ РАН
Касимов У.К.
Ташкентская Медицинская Академия
АБСТРАКТ**

Актуальность. Определение микробного состава операционной раны, молекулярно-генетической характеристики основных штаммов-контаминантов, антибиотикорезистентности микрофлоры, обоснование рациональной антибактериальной терапии инфекций в области хирургического вмешательства на сегодняшний день является весьма актуальной проблемой хирургии.

Материал. Исследованы раневые отделяемые 248 больных, оперированных в клинике Ташкентской медицинской академии за период с 2015 по 2020 годы. Все операции были разделены по классу хирургических ран.

Результаты. Микроорганизмы, изолированные из операционных ран, относятся к группе эпизодически встречающихся или случайных. Группу основной микрофлоры составляют *S. epidermidis*, *E. coli* с преимуществом выделения *S. epidermidis* в акушерском и гинекологическом отделении, *E. coli* - в хирургическом.

Заключение. Для микробиоценоза операционной раны характерно нарастание богатства видов, что служит компенсаторным механизмом низкого показателя их постоянства. Данные микроорганизмы имеют наибольший показатель значимости, зависящий от класса ран, нарастание в динамике удельного веса в моноформах и в ассоциациях.

Ключевые слова: Послеоперационная рана, нагноение раны, микрофлора раны