

THE WOUND INFECTION IN CHILDREN WITH THE SEVERE THERMAL TRAUMA

S.P. Sakharov¹, A.A. Zhidovinov²

¹ Tyumen State Academy Medicine,
Tyumen, Russia,

² Astrakhan State Medical University,
Astrakhan, Russia



*Sergey P. Sakharov, PhD
(Medicine), Department of
Pediatric Surgery*



*Alexei A. Zhidovinov, Professor,
Head of the Department of
Pediatric Surgery*

ABSTRACT — The analysis of 262 microbiological studies from the surfaces of burn wounds in children aged 6–17 has been carried out in the centre of burns in the Tyumen regional hospital N1 for 2007–2012. The associated microflora was determined in 56% of cases on the burning surface in children. *S. aureus* and *S. epidermidis* were marked in 39.3% of cases, and *P. aeruginosa* was in 10.3% of cases, *E. coli* was in 2.7% of cases. All microorganisms mentioned above have an ability to form biofilms that is why it is necessary to determine the presence of biofilms on the surface of burns for the long course of the infectious process. It is also determined that the generalized infectious process with the septic outcome was being developed in the concentration of 10^{10} of microbe cells in 1 gr. of the burn tissue.

KEYWORDS — burn, wound, microbe picture

INTRODUCTION

The thermal burns in children are very serious medical, social and economic problems in the health-care (7). The main reason of the lethal outcome in the extensive deep burns is the development of the associated infection on the burn wound surface resulting in the death in 75% of patients (1).

The moist coagulated biological tissue with constantly increasing reserve of diffused plasma nutrition substances is formed on the surface of burn wounds but the temperature of a person gives optimal conditions for the intensive microorganism reproduction. The probability of the microorganism invasion into the near-by tissues and the blood circulatory

system increases due to the bacteria reproduction. As soon the microorganisms reach the blood flow the infectious foci can appear in any body places and tissues which are not connected with the primary infectious focus but the constant bacteria reproduction on the burn wound surface create conditions for sepsis development resulting in the organism immunological reactivity decrease (9, 12).

Electromicroscopy of burn wounds showed that 60% of bioplates taken from the patient's wound surface had biofilmforming bacteria (14). The biofilms found in the wound are light and gelformed (13). They stimulate the inflammation, increase vessels permeability and both wound exudates and fibrinous scab forming. The presence of the scab can show the presence of the biofilm in the wound. The microbes being in the biofilm have noncultivated features in 6-12 hours, become resistant to antibiotics, chemiotherapeutic preparations, antiseptics and disinfectant solutions as the result of extracellular polysaccharides forming. (3,10).

O.V.Rybalchenko et al. (6) consider that the wound treatment will be effective in 24 hours concerning the planktonic bacteria fraction as well as bacteria covered with the biofilm.

Thus, the burn surface is an optimal medium for many bacteria reproduction and cultivated bacteria are released from the burn wound surface using common microbiological methods as well as noncultivated biofilmforming bacteria covered by polysaccharide

matrix. The favourable conditions for microbe population growth and the reproduction are created. So, the study of burn wound microflora is actual from the point of effective therapy administration as well as the prognosis of the infectious process development caused by microbe associations being in biofilms.

The objective of the present study is to analyze the microbe picture of the burn wounds in children with the severe thermal trauma and reveal its influence on the infectious process outcome.

MATERIALS AND METHODS

The analysis of 262 microbiological studies of samples from the burn wound surface in 103 patients aged 6–17 treated in the Tyumen regional hospital N1 has been carried out for 2007–2012. 66 boys (64%) and 37 girls (36%) having the burn II–IIIAB–IV with the injury area from 7 to 70% of the body were examined. The burn was got with hot liquids in 79.6% and it was because of flame or electrical current in 20.4% of cases. The patients were at the reanimation and the intensive care department where the antibacterial, infusion and transfuse, respiratory therapy, the nutrition, anesthesia and the local wound treatment were carried out.

The microbiological study of the wound release was carried out according to the law requirements of MH RF N535 “About the unification of microbiological (bacteriological) methods of the investigation used in the clinical and diagnostic laboratories at the medical and preventive institutions”.

The statistical analysis of samples was carried out using a computer program Statistika 6.0 using arithmetical mean taking into consideration a mean error (M+m).

STUDY RESULTS AND DISCUSSION

As a rule, local and common signs of the wound infectious process development are unspecific that is why it is necessary to develop specific methods of the laboratory diagnostics in the dynamics of the infectious process development. To improve the microbiological diagnostics it is necessary to develop innovative technologies for revealing biofilmforming bacteria at this stage.

The analysis of the microbe picture of burn wounds showed that bacteria *Staphylococcus* spp. (42.7%) and *Enterococcus* spp. (18.7%) were more often revealed on the wound surfaces. *S.aureus* and *S.epidermidis* comprised 39.3%. Epidermal *Staphylococcus* in the burn wounds was 22.5%. It is obvious that *S.epidermidis* is a specimen of a man's normal skin and mucosa microflora. The skin is a primary defensive barrier against an infection. Being injured the skin surfaces with the thermal agent *S.epidermidis* dissemina-

tion occurred on the burn surface from near-by tissues. In our opinion the burn wound was infected with these bacteria.

Bacteria *Enterococcus* spp. were revealed in 18.7% of cases. It is known that *Enterococcus* spp. is a conditional and pathogenic microorganism which can cause autoinfection. At the same time *Enterococci* have a high resistance to the influence of disinfectant solutions used in the burn centre and they can result in exogenic wound infecting in their sufficient accumulation. The presence of the extensive wound surface resulted in it too.

Among nonenzyme gram-negative microflora *Paeruginosa* was revealed in 10.3% of cases. *Pseudomonas aeruginosa* infection on the children burn surface caused long wound healing and created unfavourable conditions for healing of skin parts after donor skin transplantation.

E.coli on the burn wound surface was in 2.7% of cases.

The analysis of literature showed that bacteria *S.aureus*, *S.epidermidis*, *Paeruginosa* and *E.coli* have biofilmforming activity (2,4,11).

It is known that infecting of burn surfaces is occurred by different ways such as through air and domestic articles, due to its own conditional and pathogenic microflora, medical personnel and visitors' bacteria carriers as well as in medical procedures (1).

The fungus infection and diteroids comprise 6.5% of all investigations of burn wounds. *Candida* spp. release was 3.8%, *Bacillus* spp. was 4.9%. *Candida albicans* were revealed in one patient with the burn IIIAB which resulted in sepsis and then to the lethal outcome.

Microbe associations on burn wound surfaces were revealed in 56% of cases. 2–4 different microorganisms were released in patients. The monoculture was found in 44% of examined patients. The mixed infection including 2 types of bacteria was in 44% of cases, 3 types were in 13.3% of cases, 4 types were 2.7% of cases. The carried analysis showed that the microflora in microbe associations was senseless to antibiotics in 60%. The microbes were senseless to oxycyclin, hentamycine, ciprofloxacin, ceftazidime and etc.)

The microbe concentration on the burn wound surfaces influenced on the generalized infectious process development. In 1965 R.B.Lindberg et al. carried out an investigation to study the influence of the bacteria concentration in the burn wound surfaces on the infectious process and the prognosis of the burn disease course. It was determined that the generalized infectious process was developed in the burn wounds in the amount of 10^{-10} microbe cells in 1 g. of the tissue.

The results of 115 studies from burn wound surfaces showed that the bacteria concentration in the

burn wounds was 10^{-10} in 50.4% of cases, it was 10^{-10} in 25.2% of cases. The bacteria concentration being higher than 10^8 was registered in 24.4% of cases. Bacteremia and the generalized infectious complication (sepsis) were marked in children having the bacteria concentration of 10^{-10} microbe cells in 1 g of the studied tissue.

The analysis of the lethal outcome in 83 children with the severe thermal trauma showed that bacteremia caused by biofilmforming bacteria was observed in 50.6% of cases. *P. aeruginosa* was marked in 30.9% of cases and *S. aureus* was in 23.8% of cases. Probably noncultivated bacteria *P. aeruginosa* and *S. aureus* being in patients organism turned into the cultivated state.

So, according to the results of the microbiological investigations it was determined that the associated microflora was determined on the burn surface in children with the severe thermal trauma in 56% of cases. *S. aureus* and *S. Epidermidis* were released in 39.3% of cases. *P. aeruginosa* was in 10.3% of cases and *E. coli* was in 2.7 of cases. A specimen of the man's normal microflora (*S. epidermidis*) was a prevalent microorganism on the burn wound surfaces (22.5%). All microorganisms mentioned above have an ability to form biofilms, that is why it is necessary to determine the presence of biofilms on the burn wound surfaces in long course of the infectious process. It was also determined that bacteremia and the generalized infectious process with sepsis were marked in children having the bacteria concentration of 10^{-10} the microbe cells in 1 g. of the studied tissue.

CONCLUSIONS

1. The associated infection including 2–4 different microorganisms was in 56% of cases in children aged 1–17 having the burn trauma II–IIIAB with the injury area from 7 to 70% treated in the burn centre of the Tyumen regional hospital N1. In the microbe associations the bacteria were senseless to different groups of antibiotics in 60% of cases.
2. Epidermal *Staphylococcus* had the most percentage (22.5%) from gram-positive microflora but *Pseudomonas aeruginosa* was from gram-negative microflora.
3. The generalized infectious process with the septic outcome was in 25.2% of cases in the concentration of microbe cells 10^{-10} in 1 g. of the burn tissue.
4. The received results of the analysis of the burn wound microbe picture show the necessity of the development of methods for bacteria biofilms diagnostics being on the burn wound surfaces.

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