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PREVENTION OF VENTILATOR-ASSOCIATED PNEUMONIA IN NEWBORNS

ZAPOBIEGANIE ZAPALENIU PŁUC ZWIĄZANEMU Z WENTYLACJĄ MECHANICZNĄ U NOWORODKÓW

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ABSTRACT

The aim of the study is to optimize the prevention of the development of ventilator-associated pneumonia in newborns by developing a method for tracheal rehabilitation and assessment of its effectiveness.

Materials and methods: A prospective cohort randomized clinical study was organized, particularly artificial ventilation of the lungs was conducted on 90 newborns. Patients were divided into two groups. In the main group (n = 50) an intubation tube of author's design was used, which design allowed prophylactic tracheal sanitation on the outer wall of the intubation tube, which included vacuum aspiration of the tracheal secretion and irrigation with a solution of antiseptic decamethoxin 0.02% every 3 hours. In the comparative group (n = 40) the classical non-cuff structure of the intubation tube was used; preventive tracheal sanitation on the outer wall of the intubation tube was not carried out.

Results and conclusions: Preventive tracheal sanitation on the outer surface of the intubation tube in newborns units that undergo artificial ventilation of the lungs exhibit high efficiency against the main types of microorganisms that are dangerous from the point of view of the development of ventilator-associated pneumonia.

The use of prophylactic tracheal sanitization in newborns - patients of neonatal intensive care units, which undergoes artificial ventilation of the lungs, can significantly lower the frequency of the implementation of ventilator-associated pneumonia.

KEY WORDS: ventilator-associated pneumonia, newborns, prevention

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INTRODUCTION

One of the leading problems of managing patients in the intensive care unit is the fight against infectious complications that are associated with contamination by hospital strains of microbial flora. In the global report of the World Health Organization 2014, the following definitions have been made available on this issue [1]:

- resistance to drugs, which is the ultimate measure for the treatment of life-threatening infections, is becoming widespread in all regions of the world;
- in the conditions of resistance to antibiotics, the likelihood of death is increased;
- resistance also leads to an increase in the cost of medical care as a result of longer stay in hospitals and involves the need for more intensive care.
- key tools to counteract antibiotic resistance, such as basic monitoring and control systems for this problem, have certain disadvantages or simply do not exist in many countries.
- other important measures include the prevention of infections at the very initial stage (including - due to the fight against infections in health care facilities).

Ventilator-associated pneumonia (VAP) is one of the manifestations of hospital infection. Its frequency is 6-21 times higher than

in patients with other forms of hospital pneumonia and is 18-70% in adult patients and 3 to 22.7% in children. Each day of artificial ventilation of the lungs increases the risk of VAP occurring by 1-3%, and the mortality from this pathology reaches 70% [2-5].

VAP is defined as pneumonia, which occurred after 48 hours from the start of the artificial lung ventilator without lung infection at the time of intubation. It is the use of the intubation tube that promotes the bacterial translocation of the hospital flora into the respiratory tract through the aspiration of the oropharyngeal secretion and non sterile gastric contents on its outer surface [2-5].

In all accessible literature there are no information on this problem in the contingent of newborn babies have not been met, although they have a number of anatomical, functional, immune features that not only facilitate the implementation of the VAP, but interfere with the use of intubation tubes with a cuff and a system for the rehabilitation of the supermassive space [3, 6].

THE AIM

The aim of the study is to optimize the prevention of VAP development in newborns by developing a method for tracheal rehabilitation and evaluation of its effectiveness.

MATERIALS AND METHODS

A prospective, cohort randomized clinical study was performed on 90 newborns - patients of the neonatal intensive care units (NICU) who performed mechanical ventilation for the effects of postmenopausal asphyxia at birth (International Classification of Diseases X in the «P21: Asphyxia at Birth» heading).

Before conducting research, legal representatives of patients received written statements of informed consent to participate in the study. The study was approved by the local bioethics committee and was in line with the principles set out in the Helsinki Declaration, with further additions.

Prolonged orotraheal intubation was applied to all patients. In the study, patients were divided into two groups. Intubation tube of author's design was used in the 1st (main) group (n = 50), which differs by the presence of a sanitation port that passes through the channel of the wall of the intubation tube and contains external perforative sanitation openings [7]. Through the latter, preventive tracheal sanitation was performed, which included vacuum aspiration of the tracheal secretion and irrigation with an antiseptic solution of decamethoxin 0.02% every 3 hours.

In the 2nd (comparative) group (n = 40), the classical, non-cuff design of the intubation tube was used; preventive tracheal sanitation on the outer wall of the intubation tube was not carried out.

In all patients, a dynamic microbiological material from the tracheal secretion was performed on the 1st and 5th days of mechanical ventilation (180 studies).

Verification of the formation of the VAP was carried out according to radiological and physiological data.

The statistical analysis was carried out using descriptive statistics and nonparametric criteria, namely, the mean arithmetic (M), the representativeness error (m), the Spirman correlation coefficient (R), Pearson's χ^2 criterion, indicating the number of observations (n). For a minimum level of error-free forecast, $P \leq 0,95$ was considered, and, accordingly, the probability level of the error was $p < 0,05$.

RESULTS AND DISCUSSION

The microbial landscape of the tracheal secretion at the beginning of the study in the examined neonates (n = 90) in 5 cases (5.6%) was characterized by a combination of microorganisms and in general was as follows:

- Enterobacteriaceae family - 10% (n = 9)
- Streptococcaceae family 0% (n = 0)
- Staphylococcaceae family 1.1% (n = 1)
- group P. Aeruginosa 2.2% (n = 2)
- autochthonic flora 85.6% (n = 77)
- no growth of microorganisms 6.7% (n = 6).

The predominance of autochthonic flora, which is represented mainly by optional anaerobes, on the first day of mechanical ventilation can be explained by the natural processes of microbial colonization when passing through the delivery paths [8].

At the 5th day of study in patients with NICU, the microbial spectrum of tracheal secretion varied significantly in both groups (Table I).

Conduction of preventive sanitation was reflected in the frequency of development of the VAP. Among the newborns of the main group, the development of the VAP was found to be 10% (n = 5), which is significantly lower than that of the comparator group, where 30% (n = 12) had previously been diagnosed with VAP ($\chi^2 = 5.8$; $p < 0.05$).

The information on the table show that in contrast to patients in the main group, representatives of the Staphylococcaceae family with pathogenic properties (*S. epidermalis*, *S. aureus*) and pathogenic strains of P. group became dominant in the microbial spectrum of the tracheal secretion of the patients in the comparative group until the 5th day of stay in the P. aeruginosa (actually P. aeruginosa and Acinetobacter), which are uniquely associated with nosocomial infection [3-5]. These data indicate the effectiveness of prophylactic tracheal sanitation in newborns.

The use of decamethoxin as an agent for prophylaxis of the VAP, which was assigned by alternative routes of administration, was also noted by other authors [4].

Table I. Frequency of microorganisms' verification for the 5th day of stay in neonatal intensive care units in the tracheal secretion of newborns depending on the use of preventive sanitation

| Microorganisms | Verification of microorganisms depending on prophylactic sanitation of the trachea | | χ^2 | p | |
|---|--|-------------------------|----------|-------|---------|
| | was conducted (n=50) | wasn't conducted (n=40) | | | |
| | Colony of Enterobacteriaceae | 3 (6%) | | | 4 (10%) |
| Pathogenic and conditionally pathogenic flora | Colony of Streptococcaceae | 0 (0%) | 0 (0%) | 0 | >0,05 |
| | Colony of Staphylococcaceae | 1 (2%) | 6 (15%) | 5,2 | <0,05 |
| Group P. aeruginosa | 3 (6%) | 9 (22,5%) | 5,3 | <0,01 | |
| Autochthonous flora | 8 (16%) | 20 (50%) | 11,9 | <0,01 | |
| Lack of growth of microorganisms | 35 (70%) | 1 (2,5%) | 42,2 | <0,01 | |

CONCLUSIONS

1. In newborns requiring treatment in the conditions of NICU at the beginning of mechanical ventilation in the microflora of tracheal secretion prevails autochthonous flora;
2. During 5 days of mechanical ventilation the respiratory tract is contaminated by representatives of the Staphylococcaceae family with pathogenic properties and hospital strains of *P. aeruginosa* group;
3. Preventive tracheal sanitation on the outer surface of the intubation tube, which includes vacuum aspiration of the tracheal secretion and irradiation with a solution of antiseptic decamethoxin 0.02%, demonstrates high efficiency against the main types of microorganisms that are dangerous from the position of the VAP.
4. The use of preventive tracheal sanitation in newborns, which is performed by mechanical ventilation in the conditions of NICU, can significantly lower the frequency of VAP implementation.

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Conflict of interest:

The Author declare no conflict of interest

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