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SOME ASPECTS FOR TREATMENT OF RESPIRATORY TRACT NOSOCOMIAL INFECTIONS IN NEWBORNS AT THE INTENSIVE CARE UNIT\

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Abstract

Respiratory tract diseases are among the most topical postnatal problems in pediatrics.

The goal of the present study is to reveal nosocomial respiratory infections in intensive care unit newborns and factors promoting risks of their development, to perform microbial background study and determination of sensitivity to antimicrobial therapy.

Patients (n= 740) at the age of 0-35 days in newborn intensive care unit were studied.

Data obtained show frequent combined nosocomial infections of upper and lower respiratory tracts.

The study results allow us to recommend examination of all the newborns with non-specific pulmonary diseases by the ear, nose, throat (ENT) doctor applying specialized ENT examination, as well as use of cefalosporine range antibiotics of the second generation as antimicrobial prevention and treatment of nosocomial ENT pathology and pneumonia in intensive care unit newborns.

Keywords: Postnatal nosocomial infection, upper and lower respiratory tract, polymicrobial flora, sensitivity to antimicrobial therapy.

INTRODUCTION

Respiratory tract (RT) diseases are among the most topical postnatal problems in pediatrics. Unfortunately, nosocomial (hospital-acquired) bronchopulmonary pathology occurrence in children is far from being decreased, but on the contrary, it does increase, especially in a postnatal period [*Novikov V., 1991*]. According to literature data, the upper and lower respiratory tract infections as well as gastrointestinal tract (GIT), urinary, cutaneous and eyes infections are the most common forms of clinical manifestation of nosocomial infections (NI) in newborn reanimation and intensive care unit (RICU) [*Pickering L. et al., 2001; Nagata E. et al., 2002; Bizzaro M. et al., 2005*].

Thus, the research carried out by A. Sohn and co-authors (2001) showed that blood flow infection occurrence made 52.6%, lower respiratory tract infections: 12.9%, ENT infections: 8.6% and urinary infections: 8.6% [*Sohn A. et al., 2001*]. In a study of U. Mireya and co-authors [*Mireya U. et al., 2007*] bacteriemia (59%) and conjunctivitis (20%) were the most common forms of clinical manifestation of hospital-acquired infection.

It is worth mentioning that newborn pneumonia cases have become especially frequent and the increase of purulent forms of pulmonary inflammatory diseases has also been observed [*Gadjimirzaev G., 1980; Novikov V., 1991*]. Such aggravation of bronchial pulmonary pathology course is probably connected with a number of accompanying problems, including the present infection foci in other organs, particularly in ENT ones. According to data of different authors, non-specific pulmonary diseases (NPD) are accompanied by ENT pathology in 49-71% of cases [*Gadjimirzaev G., 1980; Baimuratova M., 1991*]. Microorganisms increased resistance to antibiotics, mixed infection cases increase and unfavourable ecologic conditions are of significant importance in infection foci development in the lungs and accessory sinuses of the nose [*Macfarlane J. et al., 1997*].

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It could be hardly supposed that the abovementioned factors influence only the lower part of the RT tract, whereas the upper part of the RT, i.e. ENT organs remain intact. Though isolated affection of bronchopulmonary tract occurs rather often, as a rule, pulmonary affection in newborns (particularly, pneumonia) is to a greater or lesser degree accompanied by expressed changes of the upper respiratory tract (URT)

According to data of some authors, the most cases of ENT pathology and nosocomial infection are of polymicrobial etiology. The causing agents are most often aerobic Gr(-), such as, *Klebsiella pneumoniae*, *Escherichia coli* and *Pseudomonas aeruginosa* and Gr(+) cocci (*Staphylococcus aureus*) [*Craven D., Steger K., 1989; Webber S. et al., 1990*].

The goal of the present study is to reveal nosocomial infections in newborn ICU, the factors promoting the risk of their development, to perform microbial background study and determination of sensitivity spectrum to antimicrobial preparations.

Material and Methods

Newborns (n=740) at the age of 0-35 days subsequently admitted to newborn RICU of Newborn Reanimation Center of the Yerevan State Medical University (YSMU) Clinical Hospital #3 during the period from December 2004 till May 2008 have been examined.

The age of newborns averaged 3.9 days (standard deviation (SD) 5.9). In the examined newborns 64.7% (n=479) were males and 35.3% (n=261): females. The material was taken from the anterior part of the nasal cavity by one sterile cotton wool pad from the both sides of the nose. Yolk-salt agar (YSA) was preferable. Fauces samples were taken by dry sterile pad for initial inoculation and chocolate agar, Sabouraud's glucose agar, and YSA were used for cultivation.

Patients' sputum was inoculated on chocolate agar, Sabouraud's glucose agar, and YSA. To reveal *staphylococci* the inoculation was done directly on Petri dish with YSA.

To reveal *colibacillus* group and *Pseudomonas aeruginosa* the inoculation was done in the enrichment media, and the pad was dipped into 10-20% bile broth or Kessler's medium. In 24 hours of incubation at 37°C, it was re-inoculated on Endo's medium. Antibiotic sensitivity study was carried out by disc-diffuse method, in which a paper disc ("Himedia", India, and "Abtek", UK) was used as an antibiotic carrier. The results were evaluated according to the diameter of growth delay zone (in mm).

Study Results

Main risk factors most often mentioned in different publications are the following: low weight at birth, lesser gestational age, application of mechanical ventilation, use of antibiotics, corticosteroids.

Average weight of the studied newborns was 2407 ± 800 g.

Percent distribution of newborns body weight (BW) at birth was as follows:

• BW under 1000 g: 3.5%;

• BW from 1001 g up to 1500 g: 13.2%;

• BW from 1501 g up to 2000 g: 19.8%,

• BW 2001 g up to 2500 g: 18% and

• BW over 2501 g: 45.5%.

Average gestational age of the newborns was 35.8±3.9 weeks. The percent of newborns born at the gestational age under 28 weeks made 5%; those at the gestational age of 28-32 weeks reached 17.8%; newborns at the gestational age of 33-37 weeks amounted 33.2%, and those at the gestational age of over 37 weeks: 44%.

In 68.1% of the examined newborns, the diagnosis on admission included this or that infection nosology. Among those admitted 58.9% had intrauterine infection; 6.5%: pneumonia; 5.3%: ENT pathology; 0.1%: integumental infection; 0.3%: purulent omphalitis, and 0.4%: conjunctivitis.

On admission, meningitis was diagnosed in 0.4% of newborns, sepsis: in 0.9% and septic shock: in 2.3%. Among hospitalized newborns, 0.9% was with intrauterine hypoxia, 3.1% with intrauterine asphyxia, and 6.6%: with intrauterine apnoea. Congenital developmental defects were revealed in

6.8% of newborns, congenital heart defects: in 7.7%. Respiratory failure of different degree was diagnosed in 75.9% of newborns on admission to RICU. CNS hypoxic failure was diagnosed in 35.4% of the admitted newborns, birth trauma: in 35.4%. Hemolytic disease was recorded in 6.5%; 0.3% newborns suffered polycetemia, and 0.3% of children had acute renal failure. Among newborns, 0.1% was admitted in the state of hemorrhagic shock, and 1.9% in hypovolemic shock condition. Inoculations (n=1022) were taken from 346 newborns with hospital-acquired infection and positive response made 61.4% (n= 627), negative: 38.6% (n= 395). Single inoculation was taken from all the patients with nosocomial infection (NI), two inoculations were obtained from 96.8% (n= 335), three inoculations from 66.5% (n = 230), four inoculations from 18.8% (n = 65), five inoculations from 8.4% (n = 29), six inoculations from 3.5% (n = 12) and seven ones – from only 1.4% (n = 5).

Different types of G+ cocci, mainly streptococci (*S. anhaemolyticus, S. hemolyticus* and *S. viridians*) were inoculated most often, non-pathogenic *neisseria* less often and in single cases *staphylococci* were observed to coincide with data of other researchers [*Stafford C., 1990; Winther B., Gwaltney J., 1990*]. The same flora was revealed in microbial study of nasal cavity discharges. Mixed microflora was also often inoculated in NI of ENT organs and nosocomial pneumonia: 47.4% (n = 36). The second microorganism in occurrence rate was *Pseudomonas*, which was isolated from the sputum in 18.4% (n= 14) of cases. Then on the occurrence rate there were *Enterobacteria*, which were isolated in 9.2 (n=7), *Escherichia coli:* in 10.5% (n = 8), *Streptococcus* in 7.9% (n = 6), coagulozonegative staphylococcus (CZNS) in 5.3% (n = 4), *Staphylococcus aureus*: in 1.3% (n = 1). Proteus Mirabilis and Candida were not inoculated in patients with nosocomial pneumonia. Data obtained due to microbiological study show great probability of co-infection of the higher and lower respiratory tracts, if chronic infection foci are present in the lungs or ENT organs. Among the isolated microorganisms, *Enterobacteria*, *CZNS*, *Pseudomonas*, *Escherichia coli*, and *Staphylococcus aureus* were the most frequently inoculated pathogens. Therefore, we attempted to study the sensitivity of these microorganisms to the most frequently applied antibiotics: ceftriaxon, ceftazidime, and amoxicillin. The results showed that 59.4% (n=193) samples were sensitive to ceftazidime among which *Staphylococcus aureus* in 68.8% (n=11), *CZNS* in 60.4% (n=84), *Escherichia coli* in 58.3% (n=28), *Pseudomonas* in 54.8% (n=23) and *Enterobacteria* in 58.8% (n=47). Ceftriaxon sensitivity showed 25.8% (n= 84) samples, among which *Staphylococcus aureus* in 37.5% (n=6), *CZNS* in 25.2% (n=35), *Escherichia coli* in 29.2% (n=14), *Pseudomonas* in 33.3% (n=14) and *enterobacteria* in 18.8% (n=15). And at last, amoxicillin sensitivity displayed 23.7% (n=77) samples, among which *Staphylococcus aureus* in 31.3% (n=5), *CZNS* in 36.7% (n= 51), *Escherichia coli* in 20.8% (n=10), *Pseudomonas* in 7.1% (n=3) and *Enterobacteria* in 10% (n = 8).

Conclusions

1. Compulsory examination of all the newborns with non-specific pulmonary diseases by otorhinolaryngologist applying specialized ENT examination (fobro-rhino-pharyngo-laryngoscopy, otoscopy, impedance audiometry, nasal transporting function determination, and, if necessary, X-ray of the accessory sinuses of the nose) is recommended.

2. Wide occurrence of infectious causative agents resistant to the effect of various medicines due to irregular use of antimicrobial drugs leads to inefficient therapy of patients with nosocomial infections.

3. Thus, use of cefalosporine range antibiotics of the second generation as antimicrobial prevention and treatment of nosocomial ENT pathology and pneumonia in newborns intensive care unit is recommended.

REFERENCES

1. *Baimuratova M.A.* [Microbiological diagnosis and study on some issues of morphogenesis in non-specific diseases of lungs] [published in Russian]. Author's Abstract of PhD Thesis in Medicine. Almaty (Kazakhstan). 1991. 24p.
2. *Bizzarro M.J., Raskind C., Baltimore R.S., Gallagher P.G.* Seventy-Five Years of Neonatal Sepsis at Yale: 1928–2003. Pediatrics. 2005; 116: 595-602.
3. *Craven D.E., Steger K.A.* Nosocomial pneumonia in the intubated patient: new concepts on pathogenesis and prevention. Infect. Dis. Clin. North Am. 1989; 3: 843-866.
4. *Gadjimirzaev G A.* [Infection foci of upper respiratory tracts and acute pneumonia in children] [published in Russian]. Otorhinolar. Herald. 1980; 1: 16-20.
5. *Macfarlane J., Prewett J., Rose D., Gard P., Guion A., Cunningham R., Myint S.* A prospective, case control study of the aetiology of community acquired lower respiratory tract infections in adults who fail to improve with initial antibiotics. BMJ. 1997; 315: 1206-1210.
6. *Mireya U.A., Martı P.O., Xavier K.V. et al.* Nosocomial infections in paediatric and neonatal intensive care units. Journal of Infection. 2007; 54: 212-220.
7. *Nagata E., Brito A.S.J., Matsuo T.* Nosocomial infections in a neonatal intensive care unit: Incidence and risk factors. Infect. Control. 2002; 30: 26-31.
8. *Novikov V. I.* [Elaboration of a system for diagnosis and stage-by-stage treatment of localized forms of lungs non-specific inflammatory diseases in children] [published in Russian]. Author's Abstract of PhD Thesis in Medicine. Perm (Russia). 1991. 21p.
9. *Pickering L.K., Cleary T.G., Guerrant R.L.* Microorganisms responsible for neonatal diarrhea. In: Remington J.S., Klein J.O., editors. Infectious diseases of the fetus and newborn infant. 5th edition. Philadelphia: WB Saunders. 2001. P. 1249-1326.
10. *Sohn A.H., Garrett D.O., Sinkowitz-Cochran R.L. et al.* Prevalence of nosocomial infections in neonatal intensive care unit patients: results from the first national point-prevalence survey. Pediatr. 2001; 139: 821-827.
11. *Stafford C.T.* The clinicians view of sinusitis. Otolaryngol. Head Neck Surgery. 1990; 103(5/2): 870-875.
12. *Webber S., Wilkinson A.R., Lindsell D., Hope P.L., Dobson S.R.M.,* Isaacs D. Neonatal pneumonia. Arch. Dis. Child. 1990; 65: 207-211.
13. *Winther B., Gwaltney J. M.* Therapeutic approach to sinusitis: antiinfectious therapy as the baseline of management. Otolaryngol. Head and Neck Surgery. 1990; 103(5/2): 876-879.