

# Clinical forms of infections in neonates hospitalized in clinic of obstetrics and perinatology within the space of one year

Jurczak A<sup>1,2\*</sup>, Kordek A<sup>3</sup>, Grochans E<sup>2</sup>, Giedrys-Kalemba S<sup>1</sup>

<sup>1</sup> Chair of Microbiology and Clinical Immunology Pomeranian Medical University in Szczecin, Poland

<sup>2</sup> The Laboratory of Propaedeutics in Nursing, Pomeranian Medical University in Szczecin, Poland

<sup>3</sup> The Clinic of Neonatal Pathology, Pomeranian Medical University in Szczecin, Poland

## Abstract

Because of their specificity, infections in neonatal units form one of the main clinical problems. Our research involved all neonates (1019) hospitalized in Clinic of Obstetrics and Perinatology within the space of one year. Clinically manifested infections were diagnosed in the total number of 47 (4.6%) newborns, including 23 (2.4%) neonates from the neonatal unit (NU) and 24 (46.2%) – from the Neonatal Intensive Care Unit (NICU). In both units, the most commonly observed were general infections (59.6%) and pneumonias (21.3%); cerebrospinal meningitis and necrotic enteritis were diagnosed in a few cases. Urinary system infections were only found in neonates hospitalized in the NU (30.5%). The course of infection was mild in most cases.

**Key words:** hospital infections, neonate.

## Introduction

Among contemporary infectious diseases, hospital infections are one of the main reasons for infections; they are found in all hospitals, from low-ranking institutions to highly specialized clinics [1]. Hospital infections reflect imperfection of the hospital procedures applied in everyday life. Because of their specificity, neonatological units are places where infections are one of the main clinical problems. Neonatal infections can be manifested by various systems, but they usually take form of general infections.

\* CORRESPONDING AUTHOR:

Samodzielna Pracownia Propedeutyki Nauk Pielęgniarskich  
Pomorska Akademia Medyczna w Szczecinie  
71-210 Szczecin, ul. Żołnierska 48, budynek 8, Poland  
Tel/fax: +48 91 4800910, fax: +48 91 4800902  
e-mail: jurczaka@op.pl (Anna Jurczak)

Received 15.05.2007 Accepted 27.03.2007

The aim of this study was to analyse clinical forms of infections and their course in neonates hospitalized over a span of one year in Clinic of Obstetrics and Perinatology.

## Material and methods

The research involved all neonates (1019) born/hospitalized in the period from March 15, 2003 to March 14, 2004 in Chair and Clinic of Obstetrics and Perinatology, Pomeranian Medical University in Szczecin – the health care institution with the third reference level. 967 newborns were hospitalized in the neonatal unit (NU), 52 neonates – in the Neonatal Intensive Care Unit (NICU).

Each child had its own infection registration card elaborated for the sake of the research. In case of suspicion of infection adequate materials were taken for microbiological analysis, namely: blood, cerebrospinal fluid, urine, bronchoaspirat (BAL), and swabs from: nasopharyngeal cavity, ear, intubation tube, anal orifice. The material was analysed in Chair and Department of Microbiology and Immunology, Pomeranian Medical University in Szczecin.

The obtained numerical values were subjected to statistical analysis. The significance of differences between the frequency of occurrence/non-occurrence of categorical variables (qualitative) of the compared units (NU and NICU) was assessed by means of: chi-square test, Yates chi-square test and Fisher exact test.

## Results

Clinically manifested infections were diagnosed in 47 (4.6%) neonates altogether, including 23 (2.4%) newborns in the NU, and 24 (46.2%) – in the NICU. Two neonates hospitalized in NICU died because of infection. Congenital infections were diagnosed in 12 babies (1.2%), among them 8 neonates

**Table 1. Clinical forms of infections in Neonatal Unit and Neonatal Intensive Care Unit from March 15, 2003 to March 14, 2004**

Clinical forms of infection n=47	NU		NICU		Statistical significance of the difference
	n=23	%	n=24	%	
Septicaemia <sup>x</sup> n=12 (25.6%)	4	17.4	8	33.3	Ins
General infections <sup>v</sup> n=16 (34%)	9	39.1	7* <sup>*</sup>	29.2	Ins
Cerebrospinal meningitis n=1 (2.1%)	0	0	1	4.2	Ins
Necrotic enteritis (NEC) n=1 (2.1%)	1	4.3	0	0	Ins
Pneumonia with lesions seen on X-rays (PNEU) n=10 (21.3%)	2	8.7	8	33.3	Ins
Urinary system infection (USI) n= 7 (14.9%)	7	30.5	0	0	<b>p&lt;0.02</b>

n – the number of neonates; Ins – statistically insignificant difference; \* – besides general infection, also skin infection in the same neonate; \* – besides general infection, also conjunctivitis in the same neonate; <sup>x</sup> – clinical and laboratory symptoms of general infection, positive blood culture; <sup>v</sup> – clinical and laboratory symptoms of general infection, negative blood culture/blood culture was not done, positive cultures from other material

**Table 2. The clinical course of hospital infections in the Neonatal Unit and Neonatal Intensive Care Unit from March 15, 2003 to March 14, 2004**

The course of infection	NU		NICU		Statistical significance of the difference
	n=23	%	n=24	%	
Slight	6	26.1	0	0	<b>p&lt;0.02</b>
Mild	12	52.2	11	45.8	NS
Severe	5	21.7	11	45.8	NS
Death	0	0	2	8.4	NS

n – the number of infected neonates

from the NU and 4 – from the NICU, while acquired infections were found in 35 (3.4%) babies, including 15 from NU and 20 from NICU. Clinical forms of infections observed in neonates were shown in *Tab. 1*.

In both units, the most commonly diagnosed infections were general infections (59.6%). All the children manifested clinical and laboratory symptoms of general infections, but positive blood culture were only noted in 12 out of 28 neonates. The rest of infants had positive culture from other clinical material. As for other clinical forms, pneumonia was relatively common (on average 21.3%); cerebrospinal meningitis and necrotic enteritis were only diagnosed in a few cases. Urinary system infections were only found in the neonates hospitalized in the NU; they made 30.5% of all infections in the above-mentioned unit. In the NICU, two babies with general infection were diagnosed on the basis of positive microbiological test results as having: the first one – infection of skin and umbilicus (positive culture of purulent secretion from the umbilical area), and the second one – conjunctivitis (purulent secretion from conjunctivas). No statistically significant differences were found in the incidence of clinical forms in both units, excepting for urinary system infections which were statistically significantly more common in the NU.

The assessment of the clinical course of neonatal infections was shown in *Tab. 2*.

Most neonatal infections both in the NU and NICU had mild character. Slight infections were statistically significantly more common in the NU, than in the NICU ( $p<0.02$ ). Severe infections were twice more frequent in the NICU, but the differences were not statistically significant.

## Discussion

The clinical form of infection is associated with the specificity of a particular hospital unit. However, such risk factors as patient's age, initial disease and the type of applied medical procedures must not be ignored. Severity of infection and its localisation in neonates depend on a baby's maturity. An infant's immune system shows signs of morphological and functional immaturity, and impairment of both specific and non-specific resistance mechanisms facilitates invasion of microorganisms and generalization of infection [2]. Nosological picture of a newborn serves as the basic criterion for diagnosing infection which often takes form of general infection/septicaemia. Most neonates show very subtle and non-characteristic clinical symptoms. Full-term babies mainly suffer from surface infections limited to skin, conjunctivas, umbilicus, and oral cavity. In the group of preterm infants treated in NICU, the most common are general blood-derivative infections (bacteremia, septicaemia – 32.3%), on the second place there are respiratory tract infections (especially pneumonia – 17.4%), then infections of skin and mucous membrane (10.5%), intestines (7.8%), postoperative wounds (5.4%) and others (26.6%) [3]. In our research, the most common clinical form of hospital infection was general infection (59.6%), just as it was in the quoted literature [4].

Blood infection is general infection and belongs to the most severe clinical forms [5]. In developed countries, the incidence of neonatal septicaemia among born-alive neonates is 1-8% depending on the unit specificity [5]. Gajewska et al. [6] imply that the incidence of septicaemia in the group of neonates

depends on their maturity and body weight. In babies with birth weight >2500 g, the occurrence frequency is from 1 to 3‰; in infants whose weight ranges from 2500 g to 1000 g, it is between 4 and 10‰, and neonates weighing <1000 g it is as much as 50‰. Our results are consistent with those presented by other authors. During the analysed period, septicaemia appeared in 4 out of 967 (0.4%) neonates hospitalized in NU and in 8 out of 52 (15.3%) babies in NICU. The percentage of septicaemias was 17.4% in NU and 33.3% in NICU of all clinical forms of infections.

For a neonatologist, a serious problem is pneumonia which can be either primary infection or the one accompanying septicaemia. In our research, pneumonia was the second most frequent clinical form of infection (21.3%). In each case it was confirmed by chest X-rays. These results correspond with those reported by other authors [6,7] who estimate the occurrence frequency of pneumonia from 20% to 32% in born-alive neonates irrespective of maturity. Epidemiology of urinary system infections is, according to Jańczewska et al. [8], as follows: during the first month of life, urinary system infections are diagnosed in 5/1000 born-alive newborns; in premature infants they are more frequent and amount to 3-5%. Gajewska et al. [6] estimate the incidence of this clinical form of infection at 0.1%-1% in born-alive infants, 10% in neonates with low birth weight, several times more often in boys than in girls. In the analysed hospital unit, urinary tract infections occurred in 7 neonates out of 1019 born-alive ones, which is 14.9% of all clinical forms; these infections were statistically significantly more common in NU than in NICU. The group of babies with diagnosed urinary tract infection included 5 female and 2 male neonates. These results do not differ much from those reported by other authors [6,8].

The incidence of cerebrospinal meningitis is assessed at 0.1-1‰ (world data) and 0.4‰ (Polish data) [6]. It depends on sex (boys suffer from cerebrospinal meningitis four-times as often as girls) and prematurity (preterm infants fall ill 10-times more often than full-term newborns). Death rate goes up to 20%, severe complications – 10-20%, moderate complications – 30-40% [6]. According to Szczapa [7] cerebrospinal meningitis is found in every third infant with septicaemia; its incidence is 0.3-2.7 per 1000 born-alive newborns and it is the reason for 4% of neonatal deaths. In our research, such clinical forms of infections as cerebrospinal meningitis and necrotic enteritis were only observed in several cases.

According to epidemiological data, necrotic enteritis is found in 10-15% of neonates with birth weight lower than 1500 g, and 5-10% – in full-term infants. In NU, 0.5-15% of cases are diagnosed, and in NICU – 2-5% of all born-alive infants. [6]. Chandrel et al. [9] estimate the incidence of necrotic enteritis in neonates requiring intensive therapy at 1-7.7%, while Iwaszko-Krawczuk et al. [10] at 12% in babies with very low birth weight. Stachowicz et al. [11] claim that necrotic enteritis was diagnosed in 0.96% of babies, including 36 infants with

weight <1000 g. In our research, necrotic enteritis was only noted in one neonate hospitalized in NU.

Mostly mild infections were observed in neonates both in NU and in NICU. Slight infections were significantly more common ( $p<0.02$ ) in NU than in NICU. Severe infections were noted in NICU twice as often as in NU, but the differences in the frequency of occurrence were not statistically significant.

The obvious thing is that neonatal infections will not be completely eliminated, and yet their incidence can be considerably reduced. This is why it is necessary to rigorously comply with the rules, to control epidemiological procedures, to constantly monitor hospital infections, and, the last but not least, to increase the expenditure on hospital hygiene.

## Conclusions

1. The most common clinical forms of infections in NU and NICU were general infections (about 60%) and pneumonias (about 21%).
2. Urinary system infections were only observed in NU.
3. Mostly mild infections were observed both in NU and in NICU.

## References

1. Jeliaszewicz J. Zagrożenia biologiczne przyszłości. Nadchodzące i ponownie pojawiające się zakażenia. *Med Praktyczna*, 1996; 7/8: 15.
2. Kierzkowska B, Pokuszyńska K, Pierzchała M, Stańczyk J. Problemy infekcyjne u noworodków z chorobami serca. *Post Neonatol*, 2002; Supl. 2: 82-6.
3. Peter G, Cashore WJ. Infections acquired in the nursery. Epidemiology and control. In: Remington JS, Klein JO editors. *Infectious diseases of the fetus and newborn infant*. Philadelphia Pennsylvania: Ed. W.B. Saunders Co. 1995, p. 1264-86.
4. Szymankiewicz M, Sękowska A, Kłyszczko C, Janicka G, Zwierzchlewski T. Oporność klinicznych szczepów *Klebsiella pneumoniae* i *Klebsiella oxytoca* na wybrane antybiotyki beta-laktamowe. *Diagn Lab*, 2001; 37: 379-85.
5. Rokosz A, Sawicka-Grzelak A, Kot K, Krawczyk E, Łuczak M. Bakteryjne zakażenia krwi u noworodków identyfikacja i wrażliwość szczepów na leki przeciwbakteryjne. *Zakażenia*, 2003; 2: 105-106, 108, 110.
6. Gajewska E, Czyżewska M. Zakażenia. In: Szczapa J. editor, *Neonatologia*, Warszawa: 2000, p. 102-42.
7. Szczapa J, Wojsyk-Banaszak I. Wybrane problemy zakażeń okresu noworodkowego. Kraków; 2005.
8. Jańczewska I, Kortecka M, Wojculewicz J, Czajkowska T, Domzalska-Popiadiuk I, Kołodziejczak E. Zakażenia układu moczowego u noworodków i wcześniaków. *Post Neonatol*, 2002; 2: 43-6.
9. Chandrel JC, Hebra A. Necrotizing enterocolitis in infants with very low birth weight. *Semin Pediatr Surg*, 2000; 9 (2): 63-72.
10. Iwaszko-Krawczuk W, Aliferi M. Wybrane zagadnienia z gastroenterologii. In: Szczapa J. editor, *Neonatologia*, Warszawa: 2000, p. 317-22.
11. Stachowicz D, Szczapa J, Gadzinowski J. Martwicze zapalenie jelit u noworodków z ekstremalnie małą urodzeniową masą ciała. *Post Neonatol*, 2003; 2 (Supl. 3): 83-8.