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Isolated Microorganisms and their Antibiotic Sensitivity Patterns of Namazi Hospital Neonatal Intensive Care Unit

Rezaie Mehrdad[1], Sanaei Dashti Anahita[2]*, Alamdari Maryam[3], Hashemi Zahra[1] and NajibKhadijeh Sadat[1]

[1]Neonatology Research Center, Shiraz University of Medical Sciences, Shiraz, Iran.
[2]Professor Alborzi Clinical Microbiology Research Center, Shiraz University of Medical Sciences, Shiraz, Iran.
[3]Shiraz Medical School, Shiraz University of Medical Sciences, Shiraz, Iran.

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Infections are important causes of morbidity, mortality and prolonged admission among the neonates. It is necessary to treat neonatal infections by empirical antimicrobial drugs, based on the epidemiologic studies of bacterial sensitivity.This study aims to determine the microorganisms involved in neonatal infections and their antibiotic sensitivity patterns. This cross-sectional study enrolled 200 neonates admitted to the central neonatal intensive care unit (NICU) of Shiraz Namazi Hospital from Oct 2013 to March 2014. Samples included blood, urine, CSF, stool, eye discharge, peritoneal fluid, ear secretion and nasal discharge. All the samples underwent culture and antibiotic sensitivity pattern. Statistical analyses were performed using version 16 SPSS software. Totally, 35% of the specimens were positive for microbial agents. The most isolated microorganisms from all samples were *Staphylococcusepidermidis*(*Staph. epidermis)* (26.8%) and *klebsiella* (17.7%). In the nasal and throat samples, *Klebsiella* was the most isolated microorganism. All *Staph.epidermis* isolates were sensitive to vancomycin.*Staph.epidermis* was most resistant to tocloxacilin and erythromycin. Pathogens responsible for neonatal infections and their antibiotic sensitivity patterns may vary over time and with hospitals. So monitoring the microbial epidemiology of neonatal infections and their susceptibility patterns is necessary to choose appropriate antibiotics.

Key words: Neonatal Intensive Care Unit; Infection; microorganisms; Antimicrobial Resistance.

Neonatal infection is an important cause of morbidity, mortality and prolonged admission among infants, particularly those born preterm and of very low birth weight (VLBW) [1]. Newborns are prone to infections and if not diagnosed and treated rapidly, may be fatal [2]. Suspected infections including sepsis, pneumonia and meningitis account for an estimated 1.4 million neonatal deaths worldwide every year [3]. After the first week of life, infections are the main cause for neonatal mortality in many countries [4]. These are mostly acquired at home or in hospital as a complication of treatment for other prenatal conditions [4]. The survival rate of low birth weight and VLBW infants in newborn intensive care unit (NICU) has increased in recent years due to technological advancements, but the prolonged duration of admission and the number of invasive procedures may increase nosocomial infections [5]. Newborn infections have a wide range of manifestations including septicemia, meningitis, pneumonia, arthritis, osteomyelitis, and urinary tract infections [6]. To decrease the mortality, it is necessary to treat neonatal infections rapidly by empirical use of antimicrobial medications and

* To whom all correspondence should be addressed.
Tel:+98-9017244313; Fax:+98-7136474303;
E-mail: anahita_sanaei@yahoo.com

based on the information on epidemiology of bacterial sensitivity patterns [7].The antibiotic resistance among bacteria is considered as a major problem in most hospitals all over the world, particularly in developing countries. Center for disease control and prevention (CDC) reported that many bacteria are resistant to two or more classes of antibiotics in both large and small hospitals [8].

This study was carried out to determine the microorganisms involved in neonatal infections and their antibiotic sensitivity patterns in a referral NICU.

Patients and Methods

This was a cross-sectional study carried out from Oct. 2013 to March 2014 in Namazi Hospital, a teaching 800 bed hospital in South of Iran. Target group were all admitted neonates. Samples including blood, urine, CSF, stool, eye discharge, peritoneal fluid, ear secretion and nasal discharge were cultured and antibiotic sensitivity data were collected.

The blood samples were collected in BACTEC special bottles and sent to be incubated in BACTEC system. The isolated colonies were identified by their colonial morphology, odor, gram stain and specific biochemical tests and sensitivity diagnosed with disc diffusion antibiogram.

Other specimens were sent to the laboratories in culture tube and transferred to a plate (blood agar, EMB). Then, incubated for 24 hours (48 hours, if needed) and the discs were selected based on the specific sensitivity patterns of the microorganisms. Collected data were analyzed by SPSS version 16.

Table 1. Positive cultures in specific specimens from NICU

Negative	positive	Result
		Specimen
75%	25%	blood
88%	12%	urine
60%	40%	Eye discharge
53%	47%	throat
59%	41%	Nasal discharge
70%	30%	others

RESULTS

Two hundred neonates were enrolled in this study. In total, 531 specimens were collected consisting of 86 blood cultures, 93 urine cultures, 119 eye discharge cultures, 119 throat cultures, 111 nasal discharge cultures and 13 cultures of the other specimens.

Among 531 cultures, 186 (35%) were positive for microbial agents and 345 (65%) were negative. Positive results for the growth of microorganisms in throat cultures outnumbered that in other samples (47%). Table 1 shows the results of cultures.

The most microorganisms isolated from all cultures were *Staph. epidermis* (26.8%) and *Klebsiella* (17.7%), as shown in Fig. 1.

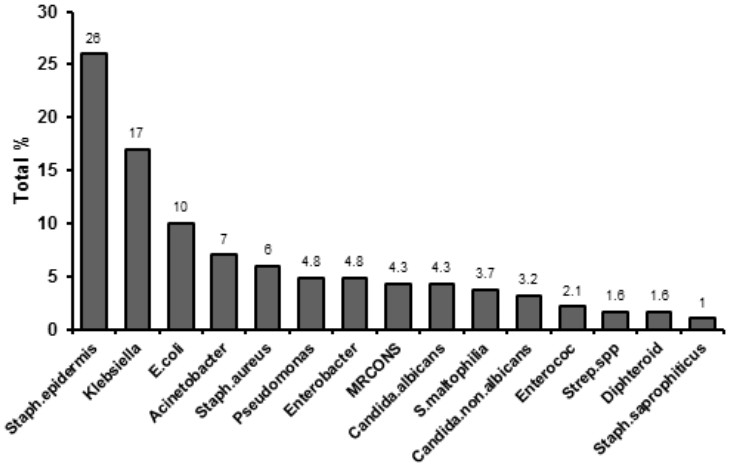

Fig. 1. Isolated microorganisms in all positive cultures from NICU

Staph.epidermis also was the most microorganism grown in the blood and eye discharge cultures(Table 2).Tables 3, 4 and 5 show the sensitivity pattern of the bacteria in specific samples.

Table 2. Isolated microorganisms according to the source of cultures from NICU.

others	Nasal discharge	throat	Eye discharge		urine	blood
2(50%)	2(4%)	5(9%)	25(52%)	-	16(76%)	*Staph. epidermis*
-	10(22%)	15(27%)	5(11%)	2(16%)	1(5%)	*Klebsiella*
-	8(18%)	10(18%)	1(2%)	-	-	*E.coli*
-	7(18%)	4(7%)	-	2(16%)	-	*Acinetobacter*
1(25%)	6(13%)	-	5(11%)	-	-	*Staph.aureus*
-	2(4%)	4(7%)	3(6%)	-	-	Pseudomonase
-	2(4%)	5(9%)	1(2%)	1(8%)	-	*Enterobacter*
-	-	3(5%)	2(4%)	-	3(14%)	MRCoNS*
-	1(2%)	3(5%)	-	4(36%)	-	*Candida. albicans*
-	3(7%)	4(7%)	-	-	-	*S. maltophilia*
-	1(2%)	2(4%)	-	2(16%)	1(5%)	*Candida.non.albicans*
1(25%)	-	-	3(6%)	-	-	*Enterococ*
-	2(4%)	-	1(2%)	-	-	*Strep.spp*
-	-	1(2%)	2(4%)	-	-	*Diphteroid*
-	1(2%)	-	-	1(8%)	-	*Staph. saprophiticus*

* Methicillin resistant coagulase negative staphylococci

Table 3. Percentage of sensitivity pattern of isolated bacteria from positive blood cultures from NICU

	Staph. epidermis	*Klebsiella*	MRCoNS
Chloramphenicle	68	100	50
Ciprofloxacin	56	100	0
Vancomycin	100	-	100
Cephalexin	61	0	-
Lincomycin	50	-	0
Trimetoprim.s	40	100	0
Gentamycin	33	0	0
Erythromycin	21	-	0
Cloxacillin	8	-	0
Amikacin	-	0	-
Tetracycline	50	0	-
Cefixim	-	0	-
Ceftizoxim	100	-	-
Cotrimoxazol	-	-	0
Cephalotin	-	-	-
Cefoxetin	-	-	-
Clindamycin	-	-	0
Oxacillin	-	-	0

DISCUSSION

The World Health Organization (WHO) estimates that globally, approximately 40% of all child deaths (under 5 years of age) are in the neonatal period (0–27 day) and one third of the mortalities are attributable to serious bacterial infections [9]. The most common pathogen in hospital-acquired neonatal sepsis is reported to be CoNS (coagulase- negative staphylococci) in developed countries [5]. On the other hand, gram negative sepsis is a problem in developing countries [10]. In the West BA study, 169 of 511 neonates admitted to NICU (33.1%) had positive blood cultures [11]. Total positive cultures in our study were 35 % (25% for blood cultures) and the prevalence of the most frequent microorganisms, *Staph. epidermis* and *Klebsiella*, in all cultures,were 26.8% and 17.7%, respectively. In the blood and eye discharge samples, the most common microorganism was found to be Staph. *epidermis*, 76% and 52% respectively, but in the nasal and throat samples *Klebsiella* was the most frequent, 22% and 27% respectively, and in urine samples *Candida albicans* accounted for 33% of all positive urine cultures. Methicillin-resistant coagulase-negative staphylococci (MRCoNS)

were the cause of 14% positive blood cultures and all were sensitive to vancomycin.

According to the study by Shrestha R et al., *Klebsiellaoxytoca* was the most common microorganism accounting for 63.6% and 36.4% of early-onset and late-onset sepsis, isolated from the blood cultures [12]. Also, Shrestha S et al. showed that Gram negative bacteria were the most common organisms isolated from blood cultures (60.64%); *Klebsiella* followed by Pseudomonas [4].

Table 4. Percentage of sensitivity pattern of isolated bacteria from positive urine culture

	Klebsiella	*Staph. Saprophiticus*	*Acinetobacter*	*Enterobacter*
Chloramphenicle	-	100	0	-
Ciprofloxacin	100	0	0	100
Vancomycin	-	100	-	-
Cephalexin	0	0	-	-
Lincomycin	-	-	-	0
Trimetoprim.s	100	0	0	100
Gentamycin	0	0	0	-
Cloxacillin	-	-	0	-
Nitrofurantoin	100	0	0	0
Norfloxacin	100	100	0	100
Nalidixic acid	50	100	0	100
Amikacin	0	0	0	0
Tetracycline	0	0	0	0
Cefixim	0	0	0	0
Ceftizoxim	0	0	0	0
Imipenem	-	-	0	-
Ceftriaxone	-	0	0	0

Table 5. Percentage of sensitivity pattern of isolated bacteria from positive eye discharge cultures from NICU

	Staph. epidermis	*klebsiella*	*Enterobac*	*Peusomonas*	*staph. aureus*	*strep . spp*	*E.coli*	*Enterococ*	MRCONS
Chloramphenicle	84	100	0	133	80	100	100	100	100
Ciprofloxacin	43	100	100	66	60	0	0	0	0
Vancomycin	100	-	-	-	100	100	-	0	100
Cephalexin	60	100	0	-	50	100	0	0	0
Lincomycin	32	-	-	-	60	100	-	0	50
Trimetoprim.s	46	100	-	33	60	0	0	0	50
Gentamycin	56	20	100	66	40	0	100	0	50
Erythromycin	16	-	-	-	0	0	-	0	0
Cloxacillin	9	-	-	-	20	0	-	0	0
Amikacin	-	20	100	66	-	-	-	-	-
Tetracycline	-	40	0	50	-	-	-	-	-
Cefixim	-	80	100	0	-	-	100	-	-
Ceftizoxim	-	80	100	33	-	-	-	-	-
Cotrimoxazol	-	-	100	100	-	-	0	-	-
Ampicillin	-	-	-	-	-	100	0	50	-
Imipenem	-	100	-	-	-	-	-	-	-
Ticarcilin	-	0	-	-	-	0	-	-	-
Cephalotin	50	-	-	-	-	0	-	0	-
Cefoxetin	-	-	-	100	-	-	-	-	-
Azithromycin	-	-	-	-	-	-	-	0	-
Ofloxacin	-	-	-	-	-	-	-	0	-

In a study conducted by Sharma CM, 137 cultures were found to be positive from 364 samples. In the same study, the most common organism was *Staphylococcus aureus* (37.22%), followed by *Klebsiellapneumoniae* (27.01%) and *Escherichia coli* (*E. coli*) (19.70%) [6]. In another study from Iran, Monsef A et al found that 105 multi-source cultures (25.5%) were positive; *E. coli* was 66.7% and *Klebciella* was 10.5%, as the most frequent bacteria isolated from urine, blood and eye excretion cultures[7].

In the present study, Staph.*epidermis* was the most common microorganism which was 100% sensitive to vancomycin. Consistent with the study of AlirezaMonsef et al. the most resistance of *Staph.epidermis* was to cloxacilin and erythromycin. As observed, *Klebsiella* (the second most common microorganism) had great resistance to cephalosporins and aminoglycoside. Also, resistance varied with samples type, for example, resistance to cephalosporins was 100% in the blood and urine and 0-20% in eye discharge samples. Meanwhile, the most effective antibiotics for *Klebsiella* were ciprofloxacin, nalidixic acid, nitrofurantoin and T.sulfamethoxazole. In the Shrestha S study, *Klebsiella* was most sensitive to amikacin and imipenem [4]. *Acinetobacter* in our study was a multidrug resistant microorganism.

CONCLUSION

In summary, pathogens causing neonatal infections exhibit varying antibiotic sensitivity patterns over time and in different hospitals. It is; therefore, essential to monitor the epidemiology of neonatal infections to update the information and choose appropriate antibiotics. Also, the emerging multi drug resistant microorganisms such as *Acinetobacter* in NICUs could be a health risk in future.

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