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Der Pharmacia Lettre, 2016, 8 (3):240-245
(http://scholarsresearchlibrary.com/archive.html)

ISSN 0975-5071
USA CODEN: DPLEB4

Prevalence and types of bacteria associated with Neonatal Sepsis in Neonatal ward from Ghaem hospital of Mashhad, Iran

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ABSTRACT

Sepsis is one of the most leading causes of mortality and morbidity in neonates in around the World. According to the WHO statistics, neonatal infection is causing five million neonatal deaths in the World annually and about 98% of deaths do occur in developing countries, so regarding importance of neonatal sepsis this study aimed to characterize Prevalence and types of bacteria associated with Neonatal Sepsis in Neonatal ward from Ghaem hospital of Mashhad, Iran. According to the information available in the archives of patient records and HIS system a total of 370 patients were studied with suspected neonatal sepsis and the collected data were analyzed by SPSS software and chi-square test. Among 370 blood culture samples from neonate with suspected sepsis 27(7.3%) samples were positive. The highest prevalent organisms were Klebsiella pneumoniae with prevalence (40.7%). And the Staphylococcus epidermidis and Staphylococcus aureus were the second and third most frequently reported isolated organisms in the blood culture specimens, with prevalence 29.6% and 14.8% respectively. In K. pneumoniae the most resistance was to Ceftriaxone (91%) and the most susceptibility to Imipeneme with sensitivity 63.7% as well as in S. epidermidis the highest resistance was to Erythromycin (66.7%) and the most susceptibility was to Vancomycin with sensitivity55.6%. In regarding our results it is recommended that clinical trials to be performed in hospital centers to compare standard antibiotic protocols with the current basic antimicrobial treatment protocols. Early identification and suitable antibiotic treatments be able to help diminish the related complications and problems.

Key words: neonatal sepsis, prevalence, Mashhad, Iran

INTRODUCTION

Sepsis is one of the most leading causes of mortality and morbidity in neonates in around the World [1]. According to the WHO statistics, neonatal infection is causing five million neonatal deaths in the World annually and about 98% of deaths do occur in developing countries [2]. The prevalence of sepsis is different from one site to another but in general, this rate (per 1000 live births), is 0.3-3 in Europe, 1-4 in North America, 1.4 in Jamaica, 8.9 in Guadeloupe, and 10 in South Trinidad [3], overall the prevalence of neonatal sepsis is between 13-45% [4]. Because the prevalence of neonatal sepsis is different from one site to another, recognition of causative agents and awareness of their sensitivity to antibacterial drugs in treatment of suspected sepsis neonates have a special importance [5]. In total sepsis is divided in two categories; early-onset sepsis and late-onset sepsis [4]. The signs and symptoms of early-onset sepsis is begin from birth moment until seven days after birth but the late-onset sepsis is begin from seventh day after birth [4]. The most common of neonatal sepsis are; *Staphylococcus aureus*, Group B streptococci, *Klebsiella* species, *Escherichia coli*, *Pseudomonas* species, *Acinetobacter baumannii* and

Streptococcus pneumonia [6-11]. Several approaches to limiting the risk of sepsis are: 1) inhibition of overgrowth and penetration of microbiota to bloodstream [12], detection and treatment of carrier of pathogenic bacteria [13, 14] inactivation of bacteria in local infections using nanothechnology [15-18] and photodynamictherapy [19-23], eradication of important extensively-, and pandrug-resistant healthcare-associated pathogen [24-28]. So, the present study aimed to characterize prevalence and types of bacteria associated with neonatal sepsis in neonatal ward from Ghaem hospital of Mashhad, Iran.

MATERIALS AND METHODS

The present study is retrospective and descriptive, in which the survey was conducted on the clinical blood cultures samples from neonatal ward, Ghaem hospital, Mashhad, Iran in 2013. According to the information available in the archives of patient records and HIS system a total of370 patients were studied with suspected neonatal sepsis. These neonates were hospitalized because they had neonatal sepsis symptoms. Then based on laboratory guidelines from suspected patients about 5-10 ml blood by the ward's nurses were drawn and inoculum in blood culture bottles, for at least a week the blood cultures were hold in 37 degrees C and in through 24, 48, 72 hours and a week after blood drawing the sub culturing on the EMB, blood agar and chocolate agar was done. After this time, regarding colonies morphology, bacterial colonies in stained smear and using diagnostic/differential media the detection and identification process was performed for isolated bacteria from positive cultures [29]and antimicrobial susceptibility testing was performed by the standard agar disk diffusion method according to Clinical and Laboratory Standards Institute (CLSI) recommendations [30].Then the collected data were analyzed by spss software. And chi-square test was used for pair differences. Differences with P Value < 0.05 were considered as significant. The antimicrobial disks were used in this study including; Tetracycline (TE), Penicillin (P), Piperacillin (PIP), Ceftazidime (CFM), Erythromycin(E), Vancomycin (V), Oxacillin (OX), Doxycyciline (D),Ciprofloxacin (CP), Gentamicin (GM), Cefotaxime (CTX),Azitromycin(AZM).Ceftazidime(CAZ),Kanamaycin(K), Ceftriaxone (CRO), Imipeneme (IMP),Cefalotin(CF), Meropenem(MEN), Cefotaxime(CTX), Cefazolin(CZ), Clindamycin(CC), Ciprofloxacin(CP).

RESULTS

Among 370 blood culture samples from suspected sepsis neonates 27(7.3%) samples were positive which of these 130 and 240 people were male and female respectively. In our study, Gram positive organisms accounted for 48.1% of all positive cultures and the prevalence of Gram negative organisms were 51.8%. The highest prevalent between isolated organisms was related to *K. pneumonia* with prevalence (40.7%). And the *S. epidermidis*, *S.aureus* were the second and third most frequently reported isolated organism in the blood culture specimens with prevalence 29.6% and 14.8%respectively (figure1).The most resistance in *K.pneumonia*e was to Ceftriaxone, Cefazolin, Oxacillin, Ceftazidime, Meropenem, Cefalotin, Kanamaycin, Ceftazidime (100%) and the most susceptibility to Vancomycin, Erythromycin with sensitivity 100% (figure3)as well as in *S.epidermidis* the highest resistance was to Erythromycin, Ciprofloxacin, Oxacillin, Clindamycin, Cefalotin, Ceftriaxone, Meropenem, Kanamaycin, Cefotaxime, Azitromycin(100%) and the most susceptibility was to Vancomycin with sensitivity 75%(figure3).

Table 1 The resistance pattern of bacterial isolates

Type of organism	The number of isolates that resistant to each antibiotic																				
	No	CZ	E	PIP	CFM	V	TE	CIP	D	OXA	CC	CF	MEN	IPM	CRO	CAZ	P	K	CT	AZM	GM
S.aureus	4	3	3	4	4	2	1	3	3	4	3	3	3	4	3	4	4	4	3	4	3
Citrobactrfreundii	1	1	1	0	1	1	0	1	1	1	1	1	0	0	1	1	1	1	0	1	1
E.coli	1	1	0	0	1	1	1	1	1	1	1	0	1	1	0	0	1	0	0	1	1
Enterococcus	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1
S.epidermidis	8	7	8	7	7	1	5	8	6	8	8	8	8	7	8	7	7	8	8	8	7
K.pneumoniae	11	11	0	10	11	10	0	10	6	11	10	11	11	7	4	11	10	11	9	10	10

***The applied antibiotics disks**: Tetracycline (TE), Penicillin (P), Piperacillin (PIP), Ceftazidime (CFM), Erythromycin(E), Vancomycin (V), Oxacillin (OX), Doxycyciline (D), Ciprofloxacin (CIP), Gentamicin (GM), Cefotaxime (CTX), Azitromycin(AZM).Ceftazidime(CAZ),Kanamaycin(K), Ceftriaxone (CRO), Imipeneme (IMP), Cefalotin(CF), Meropenem(MEN), Cefotaxime(CTX), Cefazolin(CZ), Clindamycin(CC), Ciprofloxacin(CP),*

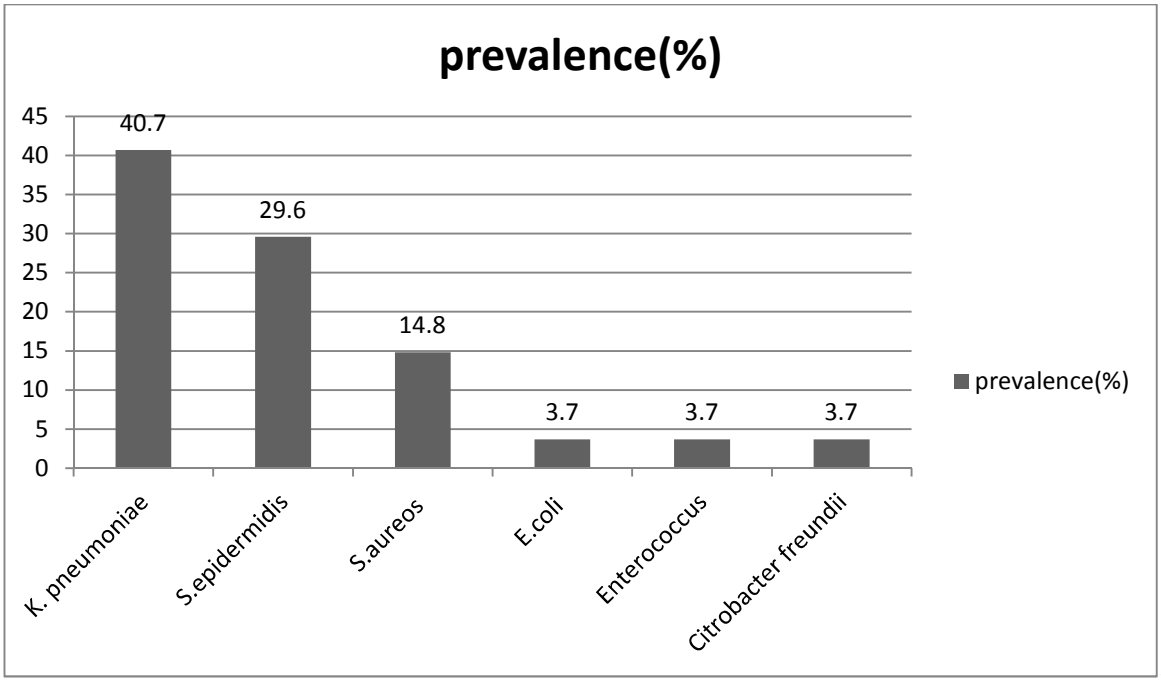

Figure 1 prevalence of isolated organisms in neonatal sepsis

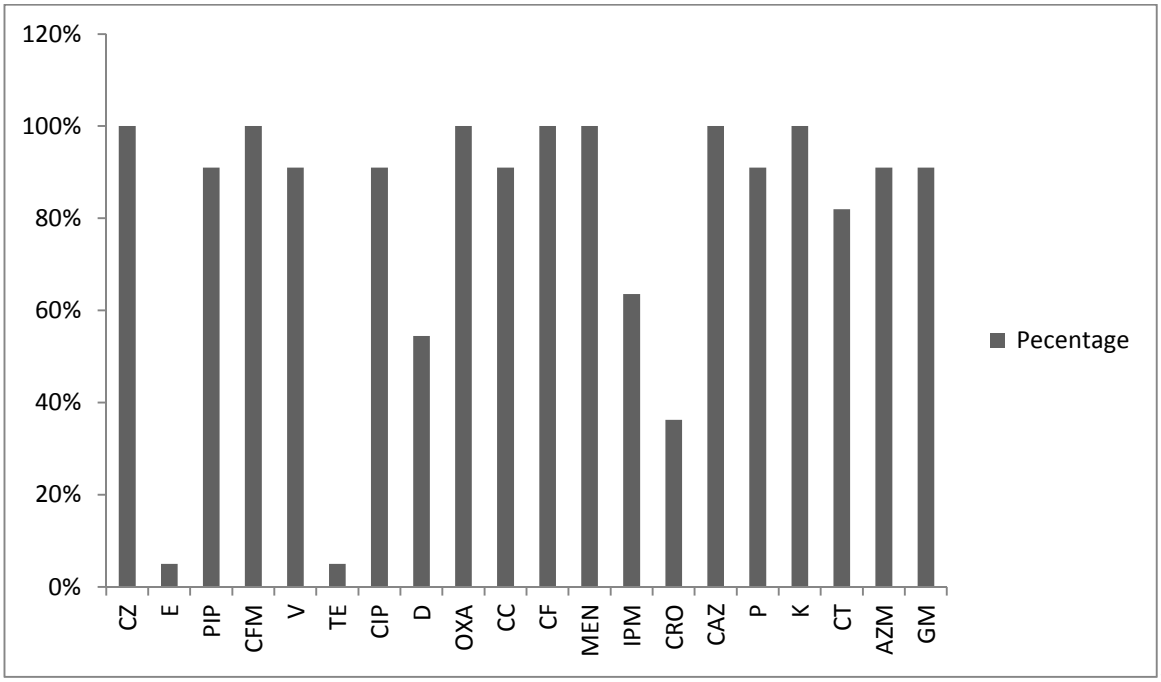

Figure2 Antibiotic sensitivity and resistance pattern of Klebsiella pneumoniae isolates

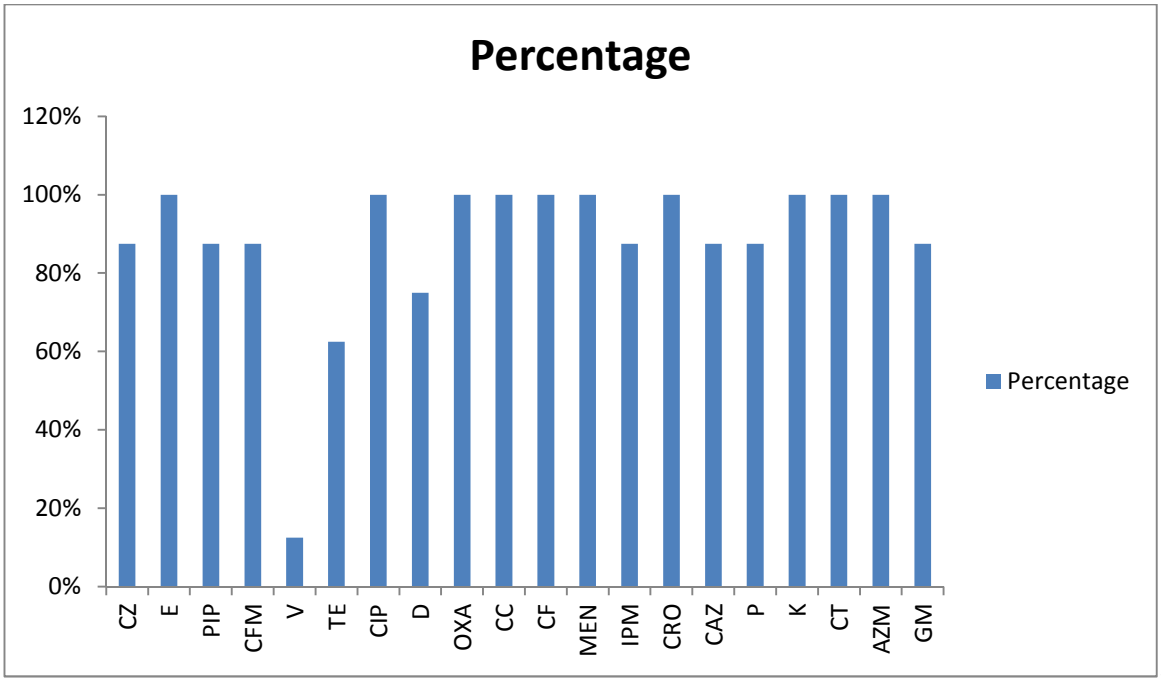

Figure3 Antibiotic sensitivity and resistance pattern of S.epidermidis

DISCUSSION

Developing countries included about 99% of the estimated 4 million neonatal deaths (accountable for about 34/1,000 live births) worldwide [31] but in developed countries wherein neonatal mortality result from sepsis is approximately 5/1,000 live births [32]. In spite of development in health system neonatal sepsis still is one of leading cause of deaths in neonates [1]. The prevalence rate of neonatal sepsis is different in each country; even in within a country from one site to another one [33]. For prevent and control of neonatal infections in each area, it appear that the epidemiologic studies and survey causing agents of infections in each area is necessary, for this reason, we performed this study on the patients with suspected neonatal sepsis and from 370 samples 27(7.3%) cases were positive, in which the most prevalent bacteria were *K. pneumonia* and *S. epidermidis* with prevalence 40.7%, 29.6% respectively. In our study, gram negative organisms accounted for 51.8% of all positive cultures, this finding is correlate with the studies carried out by Movahedian AH et al [3] and Samiya nazeer kan et al [33] whereas Gram negative organisms were 72.1% and 87.7% of all positive cultures respectively. In contrast to our study in the study conducted by Rashidi et al in Sanandaj city of Iran in 1386 on 700 samples of sepsis suspected neonates, prevalence 30% was achieved and the most common organism was *coagulase-negative Staphylococci* [34], in which the prevalence of neonatal sepsis higher than our study. Qureshi et al at the Medical Center in 1386 with study of 210 positive blood cultures in hospitalized infants, the prevalence of infection caused by Gram-positive organism (coagulase-negative Staphylococci) was 68.6% and gram negative (*K. pneumoniae*) was 31.4% [35]. In this study consistent with our study the most prevalent bacteria between gram negative and gram-positive were related to *K. pneumoniae* and coagulase-negative *Staphylococci*. In accordance with this study Maleki et al reported the prevalence 7.6% of neonatal sepsis in Kermanshah city of Iran and the highest rate of gram-positive organisms was associated with coagulase-negative *staphylococci* (28.6%) [36]. In line to our study as discussed by Kaistaha et al during 2003 to 2007 by studying 2247 blood samples, the number 296 cases were positive blood cultures that the prevalence rate of sepsis was 13.1% and the most isolated organisms was *K. pneumoniae* with prevalence 28.3% [37]. Monjur et al reported 19.4% the prevalence rate of neonatal sepsis and the most prevalent was *pseudomonas aeruginosa* (31.4%) followed by *K. pneumoniae* with prevalence 23.2% [38]. As we observed from most of conducted studies the *K. pneumoniae* like our study was one of the most common bacteria in neonatal sepsis but in some studies this was different, for example in a study conducted in Uganda in 2002 presented the most frequently bacteria were *S. aureus and E.coli* with prevalence 62.7% and 15.5% respectively and the prevalence of neonatal sepsis was 37% [39]. In another study was done in Romania the most highest organism was *pseudomonas aeruginosa* with prevalence 44% [40] and in another one which was done in Nigeria the highest rate of organism belong to *S. aureus* with prevalence 29.5% [41]. This indicate that the pattern of bacterial causing neonatal sepsis in various parts of the world is different, this difference possibly due to properties of studied population along with nursery practices and local obstetric, type of culture and patterns of antibiogram test [3]. But in the present study than other studies the prevalence rate of neonatal sepsis in the studied hospital was lower. Regarding antimicrobial susceptibility test, *K. pneumoniae* had high sensitivity rates to Vancomycin, Erythromycin with sensitivity 100%

and high resistance rates to Ceftriaxone, Ceftriaxone, Cefazolin, Oxacillin, Ceftazidime, Meropenem, Cefalotin, Kanamaycin, Ceftazidime (100%). This finding is consistent with the study conducted by Movahedian AH et al which showed that *K. pneumonia*e presented the most resistance to routinely applied antibiotics (Ampicillin) also third generation Cephalosporins [3] as well as in study conducted by x et al gram-positive and negative bacteria have presented high resistance to 3rd generation Cephalosporins [42]. In *S. epidermidis* the high resistance was to Erythromycin, Ciprofloxacin, Oxacillin, Clindamycin, Cefalotin, Ceftriaxone, Meropenem, Kanamaycin, Cefotaxime and Azitromycin (100%) and the most susceptibility was to Vancomycin with sensitivity 75%. Like our study Shaw C K et al revealed that the Gram positive organisms had the most resistance to majority of Pencillins [43]. Our study established highest resistance of imipenem against all bacterial strain, like our study in Pakistan a study showed the 100% resistance against *S. aureus* and in the same study and the study by Waseem et al have demonestrated100% sensitivity against *Acinetobacter, Klebseila* [42]. Finally the patterns of antibiotic resistance in various parts of the World is different and antimicrobial susceptibility testing should be performed by the standard agar disk diffusion method according to Clinical and Laboratory Standards Institute (CLSI) recommendations.

CONCLUSION

In regarding our results it is recommended that clinical trials to be performed in hospital centers to compare standard antibiotic protocols with the current simplified antimicrobial treatment protocols. Acquaintance of organisms causing neonatal sepsis in different regions, and their antimicrobial susceptibility, is a necessary precondition before formulating treatment strategy. Early identification and suitable antibiotic treatments be able to help diminish the related complications.

Acknowledgement
We would like to thank Mr Bagheri and Mr Zarifi and other dear personnel of clinical laboratory of Ghaem hospital for their help in this study.

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