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ORIGINAL ARTICLE

Frequency of Common Bacterial Organisms in Neonatal Sepsis in a Tertiary Care Centre

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ABSTRACT

Objective: The present study goal is to determine the frequency of various bacterial organisms in neonatal sepsis and to know the sensitivity pattern of these organisms to the commonly used antibiotics.

Methods: After the ethical approval from institutional review board, this descriptive cross-sectional study was conducted at Neonatal Intensive Care Unit of Medical Teaching Institute, Lady Reading Hospital Peshawar from Feb 5, 2020 to Aug 4, 2020. Through non-probability consecutive sampling 162 neonates between from 1st day to 28 days of life, of either gender, or gestational age of <28 weeks were included in the present study. The patient's age, gender, gestational age, birth weight, and delivery method were noted, as well as a thorough account of their current medical condition, their signs and symptoms, and any prior hospitalizations or procedures were recorded in a Performa.

Results: In this study, 162 malno children presenting with neonatal Sepsis were included. Male to female ratio was 1:0.61. The study included age ranged from 3 up to 28 days. Average age was 6.7+6.48 days. Staphlyococcus aureus was found in majority of cases which is 72(44.4%), followed by Klebsiella in 59(36.4%), Escherichia Coli in 48(29.6%), streptococci is found in 33(20.4%) children while 44(27.2%) patients have Coagulase negative staphylococci. Amikacin, amoxicillin, Cefotaxime, Imipenem and Linezolid give the same pattern as that of co-trimoxazole.

Conclusion: Babies with septic shock have undergone culture and sensitivity testing. In addition to aiding in patient care, this would also inhibit the unnecessary use of antibiotics and forestall the escalation of newborn sepsis.

Keywords: C-reative protein, Neonates, Neonatal Sepsis.

INTRODUCTION

Antibiotics are often prescribed for babies in the NICU. Systemic infection in infants less than 28 days of age is called neonatal sepsis. Sepsis is defined by the presence of a pathogen in otherwise sterile bodily fluids like blood or Cerebrospinal Fluid (CSF), in addition to the presence of clinical symptoms and raised Erythrocyte Sedimentation Rate (ESR), C - reactive protein (CRP), and pro-inflammatory cytokines (1). Infections may be spread during pregnancy from the mother to the fetus or from the mother to the fetus after birth (2, 3). Onset of sepsis in a newborn is used to categorize the condition as either early or late. If the infection occurs during the first 72 hours of life, it is classified as Early Onset Sepsis (EOS), and if it happens beyond 72 hours of life, it is classified as Late Onset Sepsis (LOS) (4). The mortality rate rises when the illness gets harder to cure due to an increase in the incidence of resistant organisms (1,5).

There are about 15 million preterm births annually, with more than 60% of them occurring in Africa and South Asia. According to the World Health Organization (WHO), there were 3.51 million premature births in India in 2016. About 15% of infant deaths worldwide in 2016 (6) were attributed to sepsis and meningitis. Neonates requiring extended intravenous access, Premature birth, endotracheal intubation, and other invasive procedures that compromise the usual protective barrier and provide a portal of entry for pathogens are all risk factors for sepsis (7). Other maternal predisposing factors include prolonged membrane rupture, fever, odorous liquid, and chorioamnionitis (8), all of which increase the risk of infection in newborns. Antibiotics are given to most premature and some full-term infants in NICUs when their mothers are at high risk for infection. The clinical course of the condition depends on a number of variables (9). These include the duration of exposure, the number and kind of bacteria present, and the neonate's immune system. Eighty percent of babies with suspected sepsis never developed anything in their blood culture and were treated sooner once symptoms appeared (10). The risk of neurodevelopmental damage, changes to the gut microbiome, and extended hospital stays associated with neonatal sepsis are present regardless of the causative pathogen (11). Proven findings link the use of Ampicillin to the colonization and invasion of the NICU by beta lactamase generating gram-negative bacteria and specific Enterobacteriaceae (12). Antibiotics are selected on the basis of local microbiological data, with antibiotic dosing being escalated or decreased as confirmed by microbiological data. The prevalence of antibiotic-resistant bacteria and other pathogens has skyrocketed in recent years. There must be constant monitoring of antibiotic resistance patterns and prudent use of antibiotics based on microbiological data from the area (13). Microbial resistance may be avoided with prudent antibiotic usage (14,15). Culture findings, intrapartum and maternal risk factors, cerebrospinal fluid cultures, complete blood cell count and differentials, radiographs, CRP trends, and clinical improvement should all be taken into account when determining the necessity for antibiotic medication. The study's goals were to: Compile a list of the most common microorganisms found in neonatal sepsis and to know the sensitivity pattern of these organisms to the commonly used antibiotics.

METHODOLOGY

After the ethical approval from institutional review board, this descriptive cross-sectional study was conducted at Neonatal Intensive Care Unit of Medical Teaching Institute, Lady Reading Hospital Peshawar from Feb 5, 2020 to Aug 4, 2020. Through non-probability consecutive sampling 162 neonates between from 1st day to 28 days of life, of either gender, or gestational age of <28 weeks were included in the present study. Neonates with sepsis who has been investigated or treated in other hospital, with congenital skin disorder, with congenital malformation, and Neonates of mothers with HIV infection were excluded from the present study. Treatment protocols and informed permission were obtained from the parents or guardians who accompanied their

children. The patient's age, gender, gestational age, birth weight, and delivery method were noted, as well as a thorough account of their current medical condition, their signs and symptoms, and any prior hospitalizations or procedures were recorded in a Performa. The senior medical officer performed a physical examination on each newborn to check for sepsis. Following an evaluation of the infant, the senior phlebotomist drew 2mL of blood using aseptic techniques before starting the baby on intravenous antibiotics. This was done in accordance with the normal procedure for blood culture, and the sample was sent to the hospital laboratory within thirty minutes. For culture growth sensitivity, it was recommended that all samples be tested for at least the set of antibiotics. Name, birth date, gestational age, gender, birth weight, delivery method, number of microorganisms, and pattern of sensitivity were all documented in a standard form called a Performa. The analysis of all data was performed in SPSS 23. Age, gestational age, birth weight, and length of sickness were all numerical variables for which means and standard deviations were computed. Categorical factors including gender, microbes, and sensitivity pattern all had their frequency and percentage distributions determined. The influence modification of microorganisms and Sensitivity Pattern was examined by stratifying by age, gestational age, newborn weight, method of delivery, and maternal immunization. A chi-square test was performed after stratification, and a P value of less than 0.05 was regarded to indicate statistical significance. Tables and graphs were used to display all of the findings.

RESULTS

Out of 162 neonates with neonatal sepsis, 94(58.02%) were male and 68(41.98%) were female patients. Table 1 shows the categorization of included neonates according to their age, 50.6% of the included neonates have the age of <3 days. Figure 2 shows the distribution of common bacteria shows that Staphylococcus aureus was found in majority of cases which is 72(44.4%), followed by Klebsiella in 59(36.4%), Escherichia Coli in 48(29.6%), streptococci is found in 33(20.4%) neonates while 44(27.2%) patients have Coagulase negative staphylococci. Table 2 shows the age-wise stratification of common bacteria in the studied neonates. Age wise distribution of common bacteria shows that Escherichia coli was found in majority of the patients having age 4-15 days which was 32.2% followed by patients having more than 15 days of age with 28.6% and 28% Escherichia coli was found in less than orequal to 3 days of age. Similar pattern have been followed by the Staphylococcus Aureus, Klebsiella and other microorganisms. Table 3 shows the gender-wise stratification of common bacteria in the studied neonates. The majority of males i.e. 26(27.7%) presented with neonatal sepsis have Esherichia coli while 22(32.4%) female neonates have Esherichia coli. Similarly 42(44.7%) male neonates have Staphylococcus aureus and 30(44.1%) female neonates have Staphylococcus aureus. 33(35.1%) male neonates have Klebsiella and 26(38.2%) female neonates have Klebsiella. At last Coagulase Negative Streptococci were found in majority of male patients which were 26(27.7%) while 18 (26.5%) female have Coagulase Negative Streptococci. Table 4 shows the antibiotic sensitivity pattern of common bacteria found in the studied neonates. The antibiotic sensitivity of common bacteria shows that staphylococcus Aureus were sensitive in 30.2% to Ampicillin, followed by Klebsiella pneumoniae in 25.9%, E coli in 21.6% and streptococci in 11.7% children. Amikacin, amoxicillin, Cefotaxime, Imipenem and Linezolid give the same pattern. Stratification of common bacteria over gestational age, birth weight and mode of delivery is shown in Table 5, Table 6 and Table 7 respectively.

Table 1: Age-wise distribution of the study participants

Age	N (%)
≤ 3.00	82 (50.6%)
4.00 - 15.00	59 (36.4%)
>16 days	21 (13%)
Mean± S. D	6.76Days+6.48

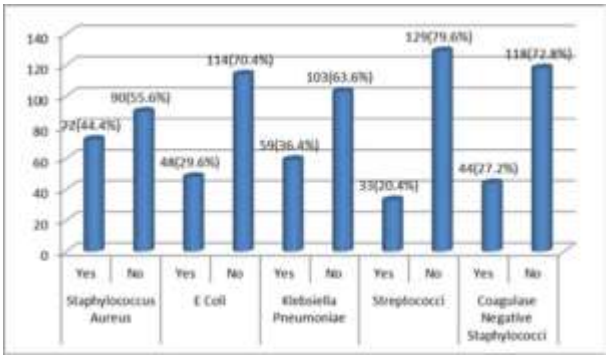

Figure I: Distribution of Microorganism in neonates with sepsis

Table 2: Age wise distribution of common bacteria

Bacterial Species		Age (Days) ≤3	4 - 15	<16	P Value
Staphylococcus aureus	Yes	35 (42.7%)	30 (50.8%)	7 (33.3%)	0.344
	No	47 (57.3%)	29 (49.2%)	14 (66.7%)	
E Coli	Yes	23 (28.0%)	19 (32.2%)	6 (28.6%)	0.862
	No	59 (72.0%)	40 (67.8%)	15 (71.4%)	
Klebsiella pneumoniae	Yes	22 (26.8%)	26 (44.1%)	11 (52.4%)	0.929
	No	60 (73.2%)	33 (55.9%)	10 (47.6%)	
Streptococci	Yes	17 (20.7%)	16 (27.1%)	0 (0%)	0.30
	No	65 (79.3%)	43 (72.9%)	21 (100%)	
Coagulase Negative Staphylococci	Yes	26 31.7%	13 (22%)	5 (23.8%)	0.415
	No	56 (68.3%)	46 (78.0%)	16 76.2%	

Table 3: Gender wise distribution of common bacteria

Bacterial species		Gender		P Value
Staphylococcus aureus	Yes	42 (44.7%)	30 (44.1%)	0.943
	No	52 (55.3%)	38 (55.9%)	
E Coli	Yes	26 (27.7%)	22 (32.4%)	0.519
	No	68 (72.3%)	46 (67.6%)	
Klebsiella pneumoniae	Yes	33 (35.1%)	26 (38.2%)	0.683
	No	61 (64.9%)	42 (61.8%)	
Streptococci	Yes	19 (20.2%)	14 (20.6%)	0.953
	No	75 (79.8%)	54 (79.4%)	
Coagulase Negative Staphylococci	Yes	26 (27.7%)	18 (26.5%)	0.867
	NO	68 (72.3%)	50 (73.5%)	

Table 4: Antibiotic sensitivity of common bacteria

		Staphylococcus Aureus		E Coli		Klebsiella Pneumoniae		Streptococci		Coagulase Negative Staphylococci	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Ampicillin	S	30.2%	39.5%	21.6%	48.1%	25.9%	43.8%	11.7%	58.0%	17.3%	52.5%
	R	14.2%	16.0%	8.0%	22.2%	10.5%	19.8%	8.6%	21.6%	9.9%	20.4%
Co- Amoxiclav	S	30.9%	35.2%	25.9%	40.1%	24.1%	42.0%	13.6%	52.5%	21.6%	44.4%
	R	13.6%	20.4%	3.7%	30.2%	12.3%	21.6%	6.8%	27.2%	5.6%	28.4%
ceftazidime	S	29.0%	38.3%	15.4%	51.9%	23.5%	43.8%	13.0%	54.3%	17.9%	49.4%
	R	15.4%	17.3%	14.2%	18.5%	13.0%	19.8%	7.4%	25.3%	9.3%	23.5%
cefepime	S	32.1%	32.1%	19.8%	44.4%	22.2%	42.0%	13.0%	51.2%	17.9%	46.3%
	R	12.3%	23.5%	9.9%	25.9%	14.2%	21.6%	7.4%	28.4%	9.3%	26.5%
Cefotaxime	S	24.7%	34.6%	20.4%	38.9%	21.0%	38.3%	14.2%	45.1%	23.5%	35.8%
	R	19.8%	21.0%	9.3%	31.5%	15.4%	25.3%	6.2%	34.6%	3.7%	37.0%
Gentamycin	S	27.2%	30.9%	25.9%	32.1%	21.6%	36.4%	13.0%	45.1%	21.0%	37.0%
	R	17.3%	24.7%	3.7%	38.3%	14.8%	27.2%	7.4%	34.6%	6.2%	35.8%
Amikacin	S	30.9%	35.2%	25.9%	40.1%	24.1%	42.0%	13.6%	52.5%	21.6%	44.4%

	R	13.6%	20.4%	3.7%	30.2%	12.3%	21.6%	6.8%	27.2%	5.6%	28.4%
Meropenem	S	29.0%	38.3%	15.4%	51.9%	23.5%	43.8%	13.0%	54.3%	17.9%	49.4%
	R	15.4%	17.3%	14.2%	18.5%	13.0%	19.8%	7.4%	25.3%	9.3%	23.5%
Imipenem	S	32.1%	32.1%	19.8%	44.4%	22.2%	42.0%	13.0%	51.2%	17.9%	46.3%
	R	12.3%	23.5%	9.9%	25.9%	14.2%	21.6%	7.4%	28.4%	9.3%	26.5%
Vancomycin	S	24.7%	34.6%	20.4%	38.9%	21.0%	38.3%	14.2%	45.1%	23.5%	35.8%
	R	19.8%	21.0%	9.3%	31.5%	15.4%	25.3%	6.2%	34.6%	3.7%	37.0%
Linezolid	S	27.2%	30.9%	25.9%	32.1%	21.6%	36.4%	13.0%	45.1%	21.0%	37.0%
	R	17.3%	24.7%	3.7%	38.3%	14.8%	27.2%	7.4%	34.6%	6.2%	35.8%
Fosfomycin	S	30.9%	35.2%	25.9%	40.1%	24.1%	42.0%	13.6%	52.5%	21.6%	44.4%
	R	13.6%	20.4%	3.7%	30.2%	12.3%	21.6%	6.8%	27.2%	5.6%	28.4%

Table 5: Gestational age wise distribution of common bacteria

Bacterial Species		Gestational Age		p-value
		≤37.00 Weeks	>37 Weeks	
Staphylococcus Aureus	Yes	38 (40.9%)	34 (49.3%)	0.286
	No	55 (59.1%)	35 (50.7%)	
E Coli	Yes	34 (36.6%)	14 (20.3%)	0.086
	No	59 (63.4%)	55 (79.7%)	
Klebsiella Pneumoniae	Yes	36 (38.7%)	23 (33.3%)	0.482
	No	57 (61.3%)	46 (66.7%)	
Streptococci	Yes	20 (21.5%)	13 (18.8%)	0.677
	No	73 (78.5%)	56 (81.2%)	
Coagulase Negative Staphylococci	Yes	25 (26.9%)	19 (27.5%)	0.926
	NO	68 (73.1%)	50 (72.5%)	

Table 6: Birth weight wise distribution of common bacteria

Bacterial Species		Birth Weight		p-value
		≤2.5 Kg	>2.5 Kg	
Staphylococcus Aureus	Yes	47 (43.1%)	25 (47.2%)	0.626
	No	62 (56.9%)	28 (52.8%)	
E Coli	Yes	25 (22.9%)	23 (43.4%)	0.075
	No	84 (77.1%)	30 (56.6%)	
Klebsiella Pneumoniae	Yes	38 (34.8%)	21 (39.6%)	0.555
	No	71 (65.1%)	32 (60.4%)	
Streptococci	Yes	21 (19.3%)	12 (22.6%)	0.617
	NO	88 (80.7%)	41 (77.4%)	
Coagulase Negative Staphylococci	Yes	29 (26.6%)	15 (28.3%)	0.820
	No	80 (73.4%)	38 (71.7%)	

Table 7: Mode of delivery wise distribution of common bacteria

Bacterial Species		Mode of delivery		p-value
		Caesarean Section	Normal	
Staphylococcus aureus	Yes	20 (41.7%)	52 (45.6%)	0.644
	NO	28 (58.3%)	62 (54.4%)	
E Coli	Yes	28 (58.3%)	75 (65.8%)	0.540
	No	20 (41.7%)	39 (34.2%)	
Klebsiella Pneumoniae	Yes	20 (41.7%)	39 (34.2%)	0.368
	No	28 (58.3%)	75 (65.8%)	
Streptococci	Yes	8 (16.7%)	25 (21.9%)	0.448
	No	40 (83.3%)	89 (78.1%)	
Coagulase Negative Staphylococci	Yes	18 (37.5%)	26 (22.8%)	0.091
	No	30 (62.5%)	88 (77.2%)	

DISCUSSION

Infant mortality and morbidity are mostly attributable to neonatal sepsis. In the underdeveloped world, the rate is much greater. The greatest strategy to reduce mortality and morbidity is by early diagnosis and appropriate treatment. The major causes of increased mortality are delays in diagnosis and starting treatment.

Conditions including septicemia, arthritis, meningitis, osteomyelitis, pneumonia, and even urinary tract infections (16) may all contribute to neonatal sepsis. Pathogen virulence, entrance route, host vulnerability and response, and disease progression across time all play a role in defining the clinical phenomenology of a given illness (17). The most frequent signs of neonatal sepsis (18) include fever, temperature instability, vomiting, diarrhea, irritability, breathing difficulty, lethargy, jaundice, low blood sugar, decreased sucking, and seizures.

Early neonatal sepsis is often caused by bacteria such Streptococcus, S. pneumoniae, L. monocytogenes, E. faecium, E. faecalis, Group D Streptococci,β -hemolytic Streptococci and Staphylococci, H. influenzae type B. Neonatal septicemia is most typically caused by Gram-negative enteric pathogens including Escherichia coli and Klebsiella species, although other Gram-negative organisms like Neisseria meningitidis and Neisseria gonorrhoeae have been documented as causes as well (19, 20).

We also found that S. aureus and Enterococcus accounted for almost half of the bacteria in our sample (44.4%). While Klebsiella and S. aureus have been shown to be the most common pathogens in previous research, this pattern shows some variation from those results. (21-23) The most common pathogens in new-born units are S. aureus, Klebsiella, and E. coli, with a high frequency of multi-drug resistance, according to recent data from Pakistan and India (24, 25).

All the isolates we tested were resistant to penicillin in our investigation. All bacterial isolates were least sensitive to ampicillin, gentamicin, and ciprofloxacin. Meropenem and vancomycin showed the highest sensitivity, followed by amikacin and cefepime. The sensitivity of vancomycin and meropenem was both 100%. Other writers have also noted the low sensitivity of routinely used antibiotics and the moderate sensitivity of amikacin (26-28) Most of the isolates were resistant to ampicillin, gentamicin, and cotrimoxazole, which is consistent with our findings and those of Tallur et al., (28).

Consistent with studies in Nepal and Indonesia, we found that very low birth weight and low birth weight were significantly associated with the development of sepsis (29, 30). The development of the immune system's defenses started between 32 and 34 weeks of pregnancy and increased after delivery. This explains why underweight infants have lower mucosal antibody levels (31). Among our research, we found that the risk of sepsis was greater among infants delivered through caesarean section.

There was a fivefold increase in the risk of sepsis for infants delivered through cesarean section. Similar results have been found in prior research conducted in Iran and Egypt (32, 33). Bleeding is a natural occurrence during surgery and might thus be a contributing factor.

There was a nine-fold increase in the probability of developing sepsis between weeks 37 of pregnancy and weeks 37 of pregnancy in the current research. Neonatal sepsis has been linked to being born before 37 weeks of pregnancy, as shown by research done in Addis Ababa, Nepal, Mexico, and Indonesia (34-37).

Our research showed that almost all isolates were susceptible to either cefotaxime or amikacin, so starting with a combination of these two antibiotics while waiting for blood culture results seems appropriate. Our new-born critical care unit has had the greatest outcomes with this combination.

CONCLUSION

When making decisions on the selection of antibiotics for empirical therapy, it is crucial to consider the significantly elevated resistance rates observed for penicillin, which is the primary antibiotic used at our facility. Exercising care is crucial while employing innovative antibiotic combinations and recently developed drugs. To effectively mitigate the dissemination of multidrug-resistant organisms, it is imperative to implement stringent infection control measures inside the neonatal intensive care unit (NICU). Furthermore, it is crucial to maintain ongoing monitoring and surveillance of bloodstream infections in newborns.

Significantly, the key components for addressing the matter encompass enhanced antenatal screening protocols for expectant mothers, improved prenatal care for neonates, and

interventions for children born with medical complications. In addition, it is important to examine empirical treatment regimens for neonatal sepsis that involve the use of ampicillin and gentamicin, due to the possibility for resistance, misdiagnosis, and mismanagement.

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