ORIGINAL ARTICLE

ANTIBIOGRAM OF BLOOD CULTURE IN PEDIATRIC PATIENTS OF SIALKOT

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Abstract:

Objectives: To assess the Antibiogram of blood culture in pediatric age group patients of AIMTH Hospital, IITH & Abdul Sattar Lab in last one year

Methods: A retrospective observational and descriptive study was conducted in April-June 2023 on the bacteriogram/ antibiogram of blood culture in pediatric age group patients of Allama Iqbal memorial teaching hospital AIMTH, Imran Idress teaching hospital IITH & Abdul Sattar lab in last one year. The data was collected from last one year complete reports and the reports that were incomplete excluded.

Results: A total of 1600 of sample were received during the study period. Out of which 606 are under 18 years. Out of 606 pediatrics age group blood Culture reports 117 show growth of different bacteria while 489 cases show no growth. The most common bacteria found was salmonalle typhi.

Conclusion: In majority of children, salmonalle typhi was grown from blood culture, which was resistant to first line drugs for this bacteria.

Keywords: Blood Culture, Antibiogram, Antibiotics, Susceptibility.

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Introduction;

Man wants to get rid of microbial invasion of blood stream, to decrease the ratio of lethal diseases & to increase span of life. Blood stream infection is a notable cause of death and morbidity in pediatric age group. Bacterial infections are seeking attentions of clinicians as a medical emergency and it requires early detection and identification of causing factors, pathogens and their pattern of antibiotics sensitivity.[1]

Bacteria produce wide range of virulent factors that destroy the human immunity and spread to remote organs. They also stimulate dysregulated host response. Blood stream infections have been shown to have high mortality rate. The incidence of bacteremia in Pakistan was reported as, 912 episodes per 1,00,000 child year with case fatality rate of 8% (95% confidence interval CI). It is seen that neonatal sepsis is a major cause of mortality in both developed & Developing countries. The reason of high rate is due to delivery and postnatal follow up performed in contaminated environment. This increases the chance of neonate to get infections as immunity is already deficient.[2]

Microbial Infections are very common in neonates and children under 18 years of

age. Children present with symptoms of fever, breathing difficulty, tachycardia, inability to feed or lethargy but some children may present without any symptoms and signs.[3]

Blood stream invasion by microbes can cause fatal problem such as shock, multiple organ failure, disseminated intravascular coagulation, and ultimately leading to death. These problems require immediate & effective management. In blood borne infections where the administration of antibiotics should be immediate, it is life threatening. [3]

The essential target of therapy is treatment with antibiotics. Blood culture is the Gold standard test for getting knowledge about pathogen, their susceptibility causative and resistance pattern in different age groups.[4]

The spectrum of causative pathogens causing infection varies across different geographical areas and changes over time even in the same place. Bloodstream infections can be caused by a wide range of microorganisms, gram positive and gram negative including enterococci, staphylococci, and enterobacteria. Gram negative bacteria are more fatal and cause serious problems.[4]

Unfortunately, antibiotics resistance is a crucial challenge now a days, drug resistance has wide variation from one region to another. The main reason of drug resistance is use of antibiotics without any recommendations from doctors. People search treatment of symptoms by their own. In Pakistan, majority of patients who are treated by certain drug, they suggest their treatments to others without consulting a doctor so people are using antibiotics and are becoming resistant to antibiotics.[4]

The cumulative antibiogram is a periodic profile of the antimicrobial susceptibilities of diverse organisms isolated from patients within a facility or can be created to study patterns of resistance in larger geographic areas utilizing data from numerous facilities. It is frequently used to track current antimicrobial susceptibility trends to direct the choice of empirical antimicrobial therapy.[5]

Biogram is an antimicrobial susceptibility test system for the determination of MICs from the standard disk diffusion test zone.[6]

Blood culture is a laboratory test that helps to determine the presence of microorganisms such as bacteria and fungi in a patient's blood, in confirmation of blood stream infections and in determining antibiotic susceptibility pattern.[6]

Blood culture is a valuable tool for diagnosis in pediatrics. But its contamination is a major problem that may happens at various stages of collecting blood for culture.[6]

The pediatric age group refers to children from birth up to 18 years of age. This age group can be further divided into different stages of development, including newborns (birth to 28 days), infants (1 to 12 months), toddlers (1 to 3 years), preschoolers (3 to 5 years), school-age children (6 to 12 years), and adolescents (13 to 18 years).[6]

T. Ghafoor undertook research on the antimicrobial susceptibility profile of patient blood culture isolates, in a tertiary care hospital with suspected newborn sepsis. Data was gathered using laboratory-based prospective research. They obtained 345 blood cultures from 345 neonates (aged 1 day to 28 days; mean age 13 days). During the course of their investigation, 76 specimens were found uculture-positive. [8]

Gramm negative bacilli were found in 44 cultures, while Gramm positive cocci were found in 32 cultures. The most frequent isolate (n = 28) was Staphylococcus aureus, followed by Escherichia coli (n=10), Klebsiella pneumonia (n=9), and

Acinetobacter spp. (n=8). Methicillin-resistant Staphylococcus aureus (MRSA) made up 25% of the culture-positive isolates (n = 19). Six patients had Pseudomonas aeruginosa isolates. Serratia species, Enterobacter species, Enterococcus species, and Proteus species were isolated from four individuals one from each. [8]

Linezolid was the most efficient antibiotic against the isolated Gramm-positive cocci, followed by sensitivity to clindamycin at 92.8%. More than 80% of the E. coli, Klebssiek, and Acinetobacter spp. isolates from the Gramm-negative group exhibited multidrug resistance. However, 88% and 71% of these isolates demonstrated tigecycline and polymyxin-B susceptibility, respectively. Their study was limit to the rural regions around Sialkot. Blood sample could not be segregated on the basis of early and late onset of neonatal sepsis. [8]

Kenechi O. Nnamani conducted a cross-sectional study at a tertiary institution in southeast Nigeria. Yielding a male-to-female ratio of 1.3:1. At entrance, the median age was 48. The most frequent bacteria found was Staphylococcus aureus 13 (43.3%). The prevalence culture of blood proven sepsis was 6.7%, while out of this 25% was fatality rate. Linezolid, vancomycin (VA), and gentamicin were sensitive to gram positive cocci but resistant to penicillin.[9]

Gram-negative microorganisms Isolates were susceptible to imipenem, ciprofloxacin, meropenem, and ceftazidime but resistant to ampicillin, ceftriaxone, meropenem, and amoxicillin-clavulanic acid. Due to a lack of facilities, anaerobic microbes were not collected for this study. The limited generalizability of the study's findings is still another drawback. The results may not be indicative of the broader population because this study was conducted in a hospital. [9]

Litegebew Yitayeh examined the bacterial antibiogram profiles, between November 2015 and May 2018. A cross-sectional study was conducted at a hospital. Numerous clinical samples taken from patients were examined using Kirby-Bauer disc diffusion susceptibility testing and aerobic bacterial isolation. Chi-square test was applied to determine whether there was any correlation between the variables, and a P- value cutoff of 0.05 was used to determine statistical significance. 134 (18.7%) of the 716 clinical specimens that were processed, had aerobic bacterial pathogens, that could be cultured. The percentage of samples with culture-confirmed positive was greater in urine (26.3%) and ear discharge (27.3%). Females were substantially more likely to be infected than males (P = 0.001).[10]

The most common bacterial isolated were Escherichia coli 63 (47.4%), Staphy-lococcus saprophyticus 17 (12.6%), and S. aureus 14 (10.4%). Remaining 61.8% of the isolates were discovered to be MDR overall. MDR was present in 90.9%, 60.9%, and 50% of the isolates of Klebsiella spp., S. aureus, and E. coli, respectively Gram-negative bacteria also showed 100% resistance to ampicillin and penicillin, as well as 20% resistance to the antibiotic nitrofurantoin.Due to the fact that this study was an institutional survey, it may not accurately represent the local population of Bahir Dar. Only antibiotics that were frequently utilised in the facility were tested. As a result, not all antibiotics used in clinical practise in the research area may be included. [10]

Tariq Mahmud Tariq conducted a study on Bacteriologic Profile and Antibiogram of Blood Culture Isolates from a Children's Hospital in Kabul Blood cultures from suspected cases of sepss were processed. Out of a total 3360 blood cultures received from in-patients, 410 yielded monomicrobial growth hence the frequency of postive bood culture was 12.2% Out of a total 410 isoates, 212 (51.71%) were gram-negative bacilli and 184 (44.88%) were grampostive

cocci In addtion, 14 (3.41%) Candidaspecies were aso isolated.[7]

The frequently isolated species of gram-negative bacteria beonged to Enterobacteriaceae, out of these 66 Klebsiella (161%), 42 Enterobacter (10.2%), 35 Escherichia E.coli (8.5%) and 16 Serratia(3.9%) species. In addition, 21 (5.12%) Pseudomonasspecies were also isolated. Correspondingly, amongst gram-positive cocci, the most frequently isolated species were 108 coaguasenegatve Staphylococci (26.34%) foowed by 49 Staphylococcus aureus (11.95%) and 21 Streptococcusspeces (5.12%). Among gram-negative isolated, those that produced ESBLi.e., 110 out of 212 (51.9%) were found to be multidrug-resistant and showed high resistance to commonly used antibiotics namely Ampicillin Gentamicin, 3rd generation Cephalosporns, Fluoroq-uinolones and Co-trmoxazole. Most of the solates were susceptible to Imipenem (200/ 212, 94.3%), Amikacin (172/ 212, 81.1%) and Fosfomycin (166/212 78.3%). Amongst gram-positive cocci, majority were resistant to Penicillin, Gentamicin, 3rd generation Cephaosporins, Fuoroqunoones and Cotri-moxazole. However, most were sensitive to Vancomycin (183/ 184) Prstna-mycin (161/ 184, 87.5%) and Fosfomycin (134/ 184, 72.8%). All Staphylococci were resistant to Pencillin and 80/157 (51%) were MRSA.[7]

Objective

- To evaluate the Biogram and anti-biogram of blood culture in children to see the sensitivity of antibiotics to different bacteria

Therefore, present study was under taken to find out etiological profile in children of Sialkot. This study also determined antibiotics susceptibility patterns and outcomes and aimed to serve as a useful guide for the pediatrician to initiate empiric antibiotics therapy.

Methodology

A retrospective observational descriptive study was conducted in April-June 2023 on the bacteriological profile and antibiogram of 606 out of 1600 blood culture of pediatric age group patients in Allama Iqbal Memorial Teaching Hospital (AIMTH), Imran Idress Teaching Hospital (IITH) & Abdul Sattar Lab in last one year. The data collected from last one year, excluding the reports that were having incomplete information.

Data collection included age and sex of the patients with the reports of the blood culture and antibiotic sensitivity testing. Blood samples were collected and processed following standard methods. The isolation and identification of organisms was done as per standard guidelines. [13, 14]

Inclusion criteria: Pediatric age group from birth to 18 years

Exclusion criteria: Reports in which age was not mentioned and having incomplete information and age more than 18 years.

Variables

Independent variables:

The Independent variables are age, gender, living situation, height, weight, BMI, and knowledge about the health status.

Dependent variable:

The dependent variable is antibiogram of blood culture of pediatric age group patients.

Results

A total sample of 1600 blood culture reports were received from labs of tertiary care hospitals & renowned lab. Out of 1600 blood cultures 606 (38%) were from pediatric age group (under 18 years), Out of 606 reports 380 were of males and 226 were of females. While out of 606 blood cultures 225 (37%) were of neonates. Only 117 (19%) showed growth of different bacteria and 489 (81%) showed no growth.

Total blood culture 606	Samples	%
0 – 28 days	225	37
> 28 days -1 year	75	12.37
> 1-5 year	82	13.5
> 5-12 year	128	21.12
> 12-18 year	96	16
Total	606	100%

Table 1: Distribution of blood culture sample and bacterial isolated among pediatric age group

Maximum numbers of samples were of neonate age group. Blood culture positivity was noted highest among neonate age group (37%) followed by children school going (21.12%).

	Bacterial isolates	No. of Neonates & Children	%
1	***Salmonella typhi***	46	39.31
2	***E. coli***	18	15.38
3	***Acinetobacter* sp.**	14	12
4	***Citrobacterfreundii***	12	10.25
5	***Burkholderia cepacia***	8	6.83
6	***S. aureus***	7	6
7	***Klebsiella pneumoniae***	3	2.5
8	***Streptococcus* sp.**	2	1.70
0	***Enterococcus* sp.**	6	5.1
0	***S.epidermidis***	1	0.85
	Total	117	100

Table 2 :No. of different bacterial species isolated from blood culture

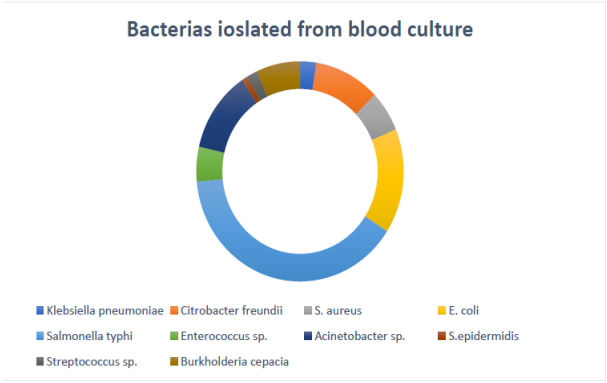

Figure-I; Bacterias ioslated from blood culture

Salmonella typhi (40%) was the most common isolated bacteria followed by E.coli (15.38 %), Acinetobacter spp. (12%), Citrobacter freundii (10.25%) and Burkholderia cepacian (6.83%) .out of 46 S.typhi blood culture reports only 7 were of neonates. The least common bacteria found in pediatric age group was S.epidermidis & streptococcus.

The antimicrobial pattern for resistant & sensitivity of different bacterias were observed, different bacteria show different pattern. Following are the sensitivity and reistant patterns of S.Typhi (most common) E.coli, Acinetobacter, Citrobacter freundii and Burkholderia cepacian.

Antibiotics	*Sensitivity %*	*Resistant %*
Amoxycillin	0	100
Azithromycin	87	13
Ceftriaxone	61	36.95
Ciprofloxacin	11	89.13

Table 3. Antimicrobial sensitivity (%) & resistant (%) pattern for Drug of Choice of S.typhi

Antibiotics	*Sensitivity %*	*Resistant %*
Tigecycline	78	22
Meropenem	67	33
Ceftriaxone	83	17
Ciprofloxacin	50	50

Table 4. Antimicrobial sensitivity (%) & resistant(%) pattern for Drug of Choice of E.coli

Antibiotics	*Sensitivity %*	*Resistant %*
Polymyxin B	93	7
Tigecycline	79	21
Meropenem	50	50
Ampicillin	29	71

Table 5. Antimicrobial sensitivity (%) & resistant(%) pattern for Drug of Choice of Acinetobacter

Antibiotics	*Sensitivity %*	*Resistant %*
Meropenem	42	58
ampicillin	58	42
Ceftriaxone	42	58
Ciprofloxacin	83	17

Table 6. Antimicrobial sensitivity (%) & resistant(%) pattern for Drug of Choice of Citrobacter

Antibiotics	*Sensitivity %*	*Resistant %*
Amoxycillin	37	63
meropenem	25	75
septran	100	0
Ciprofloxacin	100	0

Table 7. Antimicrobial sensitivity (%) & resistant (%) pattern for Drug of Choice of Burkholderia cepacia

Discussion

Bacterial infections are one of the leading causes of death in children. Knowledge of bacterial profile and antibiotic susceptibility pattern of isolates, guide, the pediatrician for the proper management of blood borne infections.

In present study the rate of bacterial culture in neonates is 38% while other studies reported 50% neonatal blood culture positivity.[7] As age increases, the positivity rate of bacterial culture decreases. Knowledge of common bacteria isolated from blood culture and their antimicrobial susceptibility in a given area helps for the choice of antibiotics. The common bacteria isolated from blood culture in present study were salmonalle typhi.

In present study the most common bacteria in neonate was E.coli while Staphylococcus aureus was the most common isolates in neonates in other studies.

As the immunity of neonates is less, and cannot endure infection, so, immediate treatment is required. In these cases waiting for results of culture & sensitivity testing is not a choice. Therefore, pediatricians require knowledge of bacteriological profile to make a rapid decision. The pattern of sensitivity and resistant of most common bacteria observed in present study, was S.typhi, which showed 100% resistance to amoxicillin & showed high resistance towards Fluor quinolone i.e. 89% but 36.9% toward ceftriaxone although showed least resistance toward azithromycin 13%. It means 61% sensitivity towards ceftriaxone and 87% sensitivity for Azithromycin.

The second common bacteria E.coli showed highest sensitivity towards ceftriaxone 83% followed by tigecycline 78%, meropenem 67% and least towards ciprofloxacin 50% in present data.

The sensitivity pattern of Acinetobacter showed highest sensitivity toward polymyxin B i.e. 93%, tigecycline i.e. 79%,meropenem i.e. 50% and ampicillin 29%. The Citrobacter sensitivity pattern showed highest sensitivity towards ciprofloxacin 83% followed by ampicillin 58% and same toward meropenem & ceftriaxone i.e, 42%.

The burkholderia cepacia showed 100% sensitivity towards septran and ciprofloxacin, 37% towards amoxycillin and 25% toward meropenem.

The knowledge of susceptibility pattern would help in treating emergency conditions like neonatal septicemia.

The study was compared with the study of Tariq Mahmud Tariq et al, who conducted a study on Bacteriologic Profile and Antibiogram of Blood Culture Isolates from a Children's Hospital in Kabul.[15] Positive growths were examined and isolates were identified by conventional biochemical tests. Out of a total 3360 blood cultures received from in-patients, 410 yielded monomicrobial growth hence the frequency of positive blood culture was 12.2% while in our study it was 19%. It showed that out of a total 410 isolates, 212 (5171%) were gram-negative bacilli and 184 (44.88%) were grampostive cocci In addition, 14 (3.41%) Candida species were also isolated.[15]

The frequently isolated species of gram-negative bacteria belonged to Enterobacteriaceae and included 66 Klebsiella(161%), 42 Enterobacter (10.2%), 35 Escherichia (E.) coli(8.5%) and 16 Serratia (3.9%) species. In addition, 21 (5.12%) Pseudomonas species were also isolated. Correspondingly, amongst gram-positive cocci, the most frequently isolated species were coagulase negative Staphylococci 108 (26.34%) followed by Staphylococcus aureus 49 (11.95%) and 21 Streptococcus species.

Among gram-negative isolates, those that produced ESBL i.e., 110 out of 212 (51.9%) were found to be multidrug-resistant and showed high resistance to commonly used antibiotics like Ampicillin Gentamicin, 3rd generation Cephalosporns, Fluoroquino-lones and Co-trmoxazole. Most of the isolates were susceptible to Imipenem (200/212, 94.3%), Amikacin (172/212, 81.1%) and Fosfomycin (166/212 78.3%). Amongst gram-positive cocci, majority were resistant to Penicillin, Gentamicin, 3rd generation Cephaosporins, Fuoroqunones and Cotrimoxazole. However, most were senstive to Vancomycin (183/184, 99%) Prstnamycin (161/184, 87.5%) and Fosfomycin (134/184, 72.8%). All Staphylococci were resistant to Pencillin and 80/157 (51%) were MSRA.

In a study conducted in Gujrat-India, a total of 247 blood culture samples received from various clinical departments of rural teaching hospital from August 2013 to September 2015. Identification of isolates and antimicrobial susceptibility was done as per standard microbiological methods. Out of 247 specimens bacteria species were isolated from 46 (18.62%) samples. Blood culture positivity was noted highest among neonates age group (38.71%) almost same to our present study .Klebsiella pneumoniae, Coagulase negative staphylo-coccus (CONs), and S. Aureus were common blood culture isolates. In neonates Klebsiella pneumoniae was the most common isolate. Out of 27 gram negative bacilli, 14 (51.85%) were having extended spectrum betalactamases (ESBL) positive. High resistance was noted against amoxicillin, amoxicillin/ clavulanic combination acid and third generation cephalosporins in all gram negative organisms except, S. typhi. Out of 12 Staphylococcus species, none of these were methicillin resistant. Routine antibiotic susceptibility surveillance helps in choice of antibiotics for treatment, identification of resistance and control of its spread.

Conclusion

S.typhi was the most common bacteria isolated, so good hygiene practices of patients, their attendants and care takers is very important especially in neonatal and pediatrics wards.

Recommendation

A regular monitoring of blood cultures in pediatric age group is necessary to understand bacteriological profile and their

antibiogram in different age group. As resistance to antibiotics is increasing, so it is recommended to maintain judicial antibiotics utilization policies within the hospital. This would support pediatrician on rational choice of antibiotics therapy.

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