Research Paper Medical Science

Study the Prevalence and Antimicrobial Susceptibility Pattern of Bacteria Isolated from Blood Cultures of Children In Baghdad

Nadheema Hammood Hussein	Department of Biology, College of Science, Al-Mustansiryah University.
ButheinaMahamed Taha	Department of Biology, College of Science, Al-Mustansiryah University.
Khetam Habeeb Rasool	Department of Biology, College of Science, Al-Mustansiryah University.
JumaahDakel Hussein	Fattima-AL-Zahra Hospital for Pediatric and Obstetric /Ministry of Health /Iraq.

ABSTRACT

The present study was carried out to determinetheprevalence of bacteriaresponsible for blood stream infection (BSI) among childrenin Fattima-AL-Zahra Hospital for Pediatric and Obstetric/ Baghdad and to get an updated knowledge about their antibiotic resistance pattern during one year period of study extended from 1 January till 31 September 2014. All blood cultures were done by BacT/ALERT 3D device.Identification of pathogens and antimicrobial susceptibility testing were done by using Vitec-2 system.A total of 1012 blood cultures were received from children suspected with blood stream infections. Out of 324positive blood cultures, the isolation rate of Gram positive and Gram negative isolates was 242 (74.69%) and 82 (25.31%), respectively.Coagulase negative Staphylococci(CoNS)was the most frequently isolated bacteria in blood cultures, 211 (87.19%) isolates (P-value< 0.05).It was shown that Escherichia coli was the most frequently isolated Gram negative bacteria in blood specimens from children patients(28.04%). The most effective antibiotics on Gram-positive isolates were Nitrofurantoin,Moxifloxacin,Tigecycline, Levofloxacin andLinezolid. In Gram negative bacteria the most effective antibiotics on these isolates were Imipenem and Meropenem.

KEYWORDS

Introduction

Blood stream infection(BSI) is a serious problem that needs immediate attention and treatment. It is a cause of high mortality especially if caused by multidrug resistant bacteria (1,2). Theyare potentially life-threatening and require rapid identification and also antibiotic susceptibility testing of the causative agent in order to facilitate specific antimicrobial therapy (3). Bacteriological culture to isolate the offending pathogen and knowledge about sensitivity pattern of the isolates remain the main stay of definitive diagnosis and managementof bloodstream infections (4,5).The results of bacteriological cultures and antibioticsusceptibility tests take 3-4 days. One key determinantin the ultimate outcome of patients withsepsis is institution of early and appropriate antimicrobialtherapy.

Thus it is a common practice to instituteearly empirical therapy with broad-spectrumantibiotics in patients presenting with clinical featuressuggestive of bacteraemia(5).Blood culture is one of the most important bacteriological examinations with important clinical and therapeutic consequences. Blood cultures should be ordered in all patients with signs suggesting septicemia, endocarditis or severe infection (6,7).

In developing countries, more than 14 million deaths of children under five years of age occur during the childhood(8), with infections accounting for up to 70% of total mortality for this age group (9).This study was aimedto determine the frequency of bacterial isolates from blood cultures of children and their antimicrobial susceptibility patterns.

Methodes

Clinical specimens

A total of 1012blood specimens were collected from children inpatients suspected with blood stream infections.

Location of study

This study was carried out at Fattima-AL-Zahra Hospital for Pediatric and Obstetric in Baghdad

Period of Study

This study was conducted during the period extended from 1 January till 31 September, 2014.

Collection of blood specimens

Allblood samples were collected from children inpatients suspected with blood stream infections prior to initiation of antimicrobial therapy. Blood samples were collectedwith duplicate blood specimens. For each blood culture,5 mL of blood were obtained from infants andchildren (≥0.5 mL for infants <1 month of age, ≥1 mL for children between 1 month and 36 months of age, and ≥4 mL for children ≥36 months of age) (10).

Isolation and Identification of bacterial isolates

Blood specimens were cultured by usedBacT/ALERT 3D device (Bio-Merieux, France), and the bacteria were isolated from all specimens according to standard microbiology methods (11). then microorganisms were identified at species level by using VITEK 2 system (Bio-Merieux, France).

Antibiotic Susceptibility Test

Antibiotic susceptibility test towards different groups of antibiotics in cluding: Benzylpenicillin, Oxacillin, Line zolid, Moxifloxacin,Tetracycline,Tigecycline,Ampicillin,Erythro mycin,Levofloxacin,Vancomycin,Aoxicillin/Clavulanic acid,Aztreonam,Clindamycin,Piperacillin/Tazobbactam, Cefazolin, Cef-

triaxon, Ceftazidime, Cefepime, Ciprofloxacin, Gentamicin, Imipenem, Meropenem, Nitrofurantoin, and Trimethoprim/ Sulfamethoxazolewas done by Vitek-2 system (Bio-Merieux, France)using AST cards according to the manufacturer's instructions.

Statistical analysis

The analysis was done by SPSS (Statistical Package for Social Sciences) version 16. Categorical variables were reported using frequencies and Fisher's test was used to analyze the significance of different observations. For all analysis, statistical significance was considered at highly significant level *P*-value of <0.01, significant level *P*-value of <0.05 and insignificant level *P*-value >0.05.

Results

Study patients

Blood specimens were collected from 1012children inpatients suspected with blood stream infections along one year of study (from 1 January till 31 September, 2014). The age of children patients ranged from 3days to less than 12 years. Patients with age grouping less than three months were much higher than other age grouping,657 (64.92%) vs. 355 (35.08%) out of1012 children patients(*P-value*< 0.05).

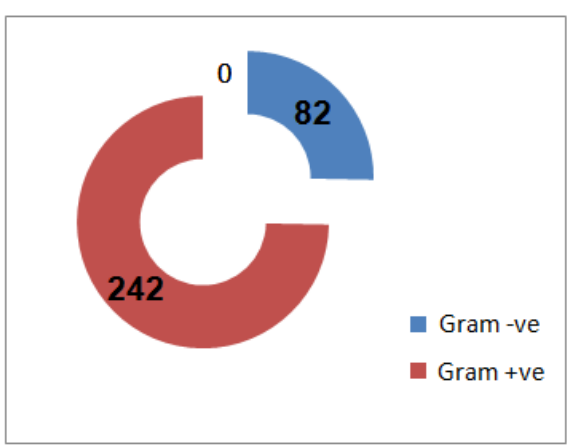
Blood culture

The frequency of positive blood culture that indicates true bacteremia in the studied patients was 324 (32.01%) casesout of 1012 blood specimens.The majority of positive blood cultures were from patients within the age group less than three months, 256 (79.01%) patients vs. 68 (20.99%)(*P-value*< 0.05).

Frequency ofbacteria among blood culture

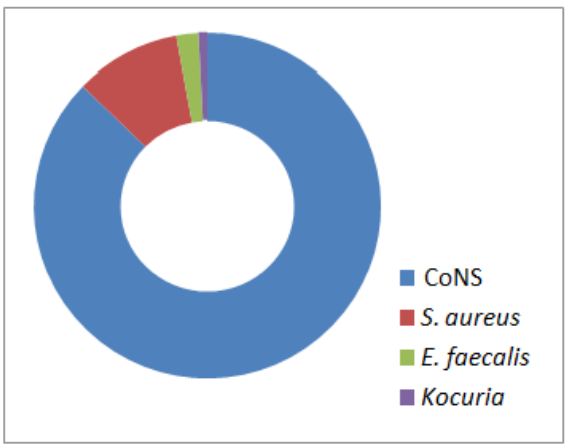
Frequency ofisolated bacteria causing BSI inFattima-AL-Zahra hospital weresummarized in table-1. In which out of 324positive blood cultures,the isolation rate of Gram positive and Gram negative isolates was 242(74.69%) and 82(25.31%), respectively (figure-1).

Figure-1: Numbers of Gram -Positive and Gram –Negative bacteria isolated from blood cultures.



As shown in table -1 and figure-2, coagulase negative staphylococci(CoNS) was the most frequently isolated bacteria in blood cultures, 211(87.19%) isolates (*P-value*< 0.05)followed by*Staphylococcus aureus*isolates(9.91%).

Figure-2: Numbers of Gram positivebacteria isolated from blood cultures.



It also shown in table-1 that *Escherichia coli*23(28.05%) was the most frequently isolated Gram negative bacteria in blood cultureofchildren patients followed by *Klebsiella pneumonia* and *Acinetobacterbaumannii*16(19.51%).

Table-1:Frequencyand distributionof bacterialisolates from blood cultures.

Gram positive bacteria	No.	%
Coagulase negative staphylococci	211	87.19
Staphylococcus aureus	24	9.91
Enterococcus faecalis	5	2.07
*Kocuria*spp.	2	0.83
Total	242	100
Gram negative bacteria	No.	%
Escherichia coli	23	28.04
Klebsiella pneumoniae	16	19.51
Acinetobacterbaumannii	16	19.51
Enterobacter cloacae	7	8.54
Pseudomonas aeruginosa	6	7.32
*Citrobacter*spp.	6	7.32
Serratiamarcescens	3	3.66
Pantoea spp.	3	3.66
Aeromonassobria	2	2.44
Total	82	100

The susceptibilityrate toall antibiotics for Gram -Positive and Gram-Negative bacteria was summarized in table -2 and table-3, respectively.In Gram-Positive bacteriathe most effective antibiotics wereNitrofurantoin,Moxifloxacin,Tigecycline, Levofloxacin andLinezolid which showed 100%sensitivity ratefollowed byvancomycin.This study also showed a highest resistance tooxacillin and benzylpenicillin. On the other hand, the bacterial isolates were revealed different degrees of resistance towards remaining antibiotics table -2.

Table-2: Susceptibility of Gram-positive isolated bacteria **towards various antibiotics.**

In Gram-Negative bacteria, the rate of sensitivity to ampicillin and cefazolinwas very low (0%), whilethe most effective antibiotics against Gram-Negative isolates were imipenem and meropenem which showedsensitivity rate 100% for all Gram-Negative bacteria except*Klebsiella pneumonia*which showed sensitivity rate93.75% forimipenem and meropenem.

On the other hand, the Gram-Negative bacteria were revealed different degrees of sensitivity towards remaining antibioticsas shown in table -3.

Antibiotics	**CoNS** N=211	S. aureus **N=24**	***E. Faecalis*** **N=5**	***Kocuria*** **spp. N=2**
	S%	S%	S%	S%
Benzylpenicillin	0	0	60	0
Ciprofloxacin	46.45	87.5	60	50
Clindamycin	56.4	54.17	0	0
Erythromycin	23.22	58.33	0	0
Gentamicin	59.72	91.67	20	50
Levofloxacin	100	100	100	100
Linezolid	100	100	100	100
Moxifloxacin	100	100	100	100
Nitrofurantion	100	100	100	100
Oxacillin	9.95	8.33	20	0
Tetracycline	58.42	62.5	0	0
Tigecycline	100	100	100	100
Trimethoprime-Sulphamethoxazole	46.45	83.22	60	50
Vancomycin	92.89	91.67	80	100

Table-3: Susceptibility of Gram-Negativeisolated bacteria towards various antibiotics.

Antibiotics	Escherichia coli **N=23**	***Klebsiella penumoniae*** **N=16**	***Acinetobacterbaumannii.*** **N=16**	***Enterobactercloacae*** **N=7**	***Pseudomonas Aeruginosa*** **N=6**	***Citrobacter***spp. ***N=6***	***Serratiamarcescens*** **N=3**	***Pantoea***spp. **N=3**	*Aeromonassobria* N=2
	S%	S%	S%	S%	S%	S%	S%	S%	S%
Amoxicillin-Clavulanic acid	52.17	25	6.25	0	0	33.33	0	33.33	50
Ampicillin	0	0	0	0	0	0	0	0	0
Aztreonam	13.04	12.5	0	14.29	33.33	33.33	66.66	33.33	50
Cefazolin	0	0	0	0	0	0	0	0	0
Cefepime	4.35	6.25	25	57.14	66.66	16.67	100	33.33	50
Ceftazidime	8.7	6.25	6.25	14.29	83.33	16.67	100	33.33	50
Ceftriaxone	4.35	12.5	6.25	14.29	16.67	16.67	100	33.33	50
Ciprofloxacin	60.87	87.5	31.25	85.71	16.67	0	33.33	33.33	100
Gentamicin	56.52	18.75	25	14.29	33.33	16.67	33.33	0	100
Imipenem	100	93.75	100	100	100	100	100	100	100
Levofloxacin	65.22	87.5	37.5	85.71	33.33	16.67	33.33	33.33	100
Meropenem	100	93.75	100	100	100	100	100	100	100
Nitrofurantion	86.96	37.5	12.5	28.57	0	83.33	0	0	100
Piperacillin-Tazobactam	82.61	62.5	73.5	85.71	100	83.33	100	66.66	100
Tetracycline	56.52	31.25	50	42.86	33.33	16.67	66.66	33.33	50
Trimethoprime-Sulphamethoxazole	30.43	12.5	93.75	28.57	0	83.33	33.33	66.66	50

Discussion

Prompt diagnosis and effective treatment are necessary to prevent complications and to reduce mortality from BSI (12). In this study, out of 1012 blood specimens, the frequency of positive blood culture that indicated true bacteremia in the studied patients was 324 (32.01%) cases. In comparison with other studies, In an Indian study the positivity of blood culture was 42% (770/1828) (13).

In the current study, coagulase-negative staphylococci were the most common isolates as in others (8,14).The isolation rate of Gram positive and Gram negative isolates was 242 (74.69%) and 82 (25.31%), respectively. Coagulase negative *Staphylococcus* was the most frequently isolated bacteria in blood cultures, 211 (87.19%) isolates as in other study done byKalantar*et al.* (8). In 2005, Mamishi et al. (15) reported a predominance of gram-positive isolates 72% from children in a Children's Medical Center, Tehran: the most common of which was Coagulase-negative staphylococci which accounted for 48.4%.

Amongst the gram-negativebacteria the most common organism was *Escherichia coli* and this is similar to (16), while another study (12) found that *Klebsiella Spp.*were themost common gram-negativeisolates.

In our study, the Gram positive isolated bacteria, showed the greatest susceptibility to Nitrofurantoin,Moxifloxacin,Tigecycline, Levofloxacin andLinezolid. In other handthe Gram negative isolated bacteria, showed the greatestsusceptibility tolmipenem and Meropenem and Maximum resistance was seen againstAmpicillin and this agreement with the study done by Arora and Devi (17).

REFERENCES

1. Murty, D.S. and Gyaneshwari, M. (2007). Blood cultures in paediatric patients: A study of clinical impact. Indian J Med Microbiol. 25: 220-224. | 2. Diekema, D.J. andBeekmann, S.E. (2003). Come of nosocomial and community-onset bloodstream infection. J ClinMicrobiol. 41(8): 3655 -3660. | 3. Berit, E. C.; Maria, P. S.; Jorg, G.; Salima, M.; Martin, K. and Oleg, K. (2006). Identification and characterization of bacterial pathogens causing bloodstream infections by DNA microarray.J ClinMicrobiol. 44(7): 2389-2397. | 4. Jain, A.; Roy, I.; Gupta, M. K.; Kumar, M. andAgarwal, S. K.(2003). Prevalence of extended-spectrum ß-lactamase-producing Gram-negative bacteria in septicaemic neonates in a tertiary care hospital. J Med Microbio.l 52: 421-425. | 5. Shahlalat, M. Anwar, S. and Ahmad, I. (2009). Bacterial Pathogens Responsible for Blood Stream Infection (BSI) and Pattern of Drug Resistance in a Tertiary Care Hospital of Lahpre. Biomedica. 25: 101 – 105. | 6. Gaynes, R. and Edwards, J.R. (2005). National Nosocomial Infections Surveillance, System. Overview of nosocomial infections caused by gram-negative bacilli. Clin Infect Dis. 41: 848-856. | 7. Biedenbach, D. J.; Moet, G. J. and Jones, R. N. (2004). Occurrence and antimicrobial resistance pattern comparisons among bloodstream infection isolates from the SENTRY Antimicrobial Surveillance Program (1997-2002). DiagnMicrobiol Infect Dis. 50: 59-66. | 8. Kalantar, E.; Motlagh, M.; Lordnejad, H. and Beiranvand, S. (2008). The Prevalence of Bacteria Isolated from Blood Cultures of Iranian Children and Study of their Antimicrobial Susceptibilities. Jundishapur Journal of Natural Pharmaceutical Products. 3(1): 1-7. | 9. Mylotte, J. M. and Tayara, A. (2001). Blood cultur- es: clinical aspects and controversies. Eur. J. Microbiol. Infect. Dis.; 9: 157–163. | 10. Connell, T. G.; Rele, M. and Cowley, D. (2007). How reliable is a negative blood culture result? Volume of blood submitted for culture in routine practice in a children's hospital. Pediatrics; 119: 891-894. | 11. Murray, P. R.; Baron, E.J. and Jorgensen, J.H. (2003). editors: Manual of Clinical Microbiology, ed 8, Washington DC, ASM Press. | 12. Latif, S.; Anwar, M. S. and Ahmad, I. (2009). BACTERIAL PATHOGENS RESPONSIBLE FOR BLOOD STREAM INFECTION (BSI) AND PATTERN OF DRUG RESISTANCE IN A TERTIARY CARE HOSPITAL OF LAHORE. Biomedica. 25: 101 – 105. | 13. Shafazand, S. and Weinacker, A. B. (2010).Blood cultures in the critical care unit: improving utilization and yield. Chest. 122(5): 1727-36. | 14. Amita, J.;Indranil, R.;Mahendra, K.G.; Mala, K. andAgarwal, S.K. (2003). Prevalence of extended-spectrum ß-lactamase- prou- cinggram-negative bacteria in bacteremiacaemic neonates in a tertiary care hospital. J. Med. Microbiol. 52: 421-25. | 15. Mamishi, S.;Pourakbari, B.;Ashtiani, M.H. andHashemi, F.B. (2005). Frequency of isolation and antimicrobial suscep- tibility of bacteria isolated from bloodstream infections at Children's Medical Center, Tehran, Iran, 1996-2000. Int. J. Antimicrob. Ag. 6(5): 373-79. | 16. Ghadiri, H.;Vaez, H.;Khosravi,S. and Soleymani, E. (2012).The Antibiotic Resistance Profiles of Bacterial StrainsIsolated from Patients with Hospital-Acquired Bloodstreamand Urinary Tract Infections.Critical Care Research and Practice. 2012: 1-6. | 17. Arora, U. and Devi, P. (2007). Bacterial Profile of Blood Stream Infections and Antibiotic Resistance Pattern of Isolates. JK SCIENCE. 9 (4): 186-190.