

ORIGINAL ARTICLE

Spectrum and Drug Sensitivity of Common Pathogens Causing Septicemia in Children

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ABSTRACT

Objective: To investigate the spectrum and drug sensitivity of pathogenic bacteria in children presenting with septicemia.

Methods: A retrospective analysis was performed on the spectrum and drug sensitivity of pathogenic bacteria in 450 children (age 0—5 years) with septicemia, who were admitted from January to December, 2014.

Results: A total of 450 blood culture samples were collected. Out of these 30% were cultures positive. Gram negative bacteria were 63% of total isolates and gram positive were 37%. The commonest gram negative bacterial isolates were E Coli (22%) followed by Klebsiella (11%), acinetobacter (9%), pseudomonas (8%), salmonella typhi (6%), salmonella paratyphi (4%) and hemophilus influenza type B (3%). Among the gram positive organisms commonest organisms were staphylococcus aureus (15%), staphylococcus epidermidis (10%), methicillin resistant staphylococcus (MRSA) (7%) and pneumococcus (5%).

Conclusion: E Coli was the most commonly isolated pathogen in pediatric age group less than 5 years sensitive to third generation cephalosporins and aminoglycosides⁽¹⁾. Commonest gram positive isolate was staphylococcus aureus which was sensitive to amoxicillin + clavulanic acid, aminoglycosides and vancomycin.

Key words: Septicemia, Escherichia coli (Ecoli), Klebsiella, Pseudomonas, MRSA

INTRODUCTION

Septicemia is a common condition in children with a resultant high mortality and morbidity⁽²⁾. Clinical spectrum varies from SIRS (Systemic inflammatory syndrome) to septic shock and multiorgan failure (MODS)⁽⁸⁾. Despite aggressive treatment mortality ranges from 15% in patients with sepsis to 40-60% in septic shock. Bacterial infections are the most common cause of sepsis. Viruses and fungi can also cause sepsis. 30-40% of patients with sepsis have positive blood cultures. Common gram negative organism causing sepsis are Ecoli, klebsiella, enterobacter, salmonella typhi, salmonella paratyphi, pseudomonas and hemophilus influenza^(3,4). Common gram positive organisms are staphylococcus aureus and streptococcus pneumoniae⁽⁵⁾. Streptococcus pneumoniae, neisseria meningitidis and staph aureus usually cause sepsis in the child. Sepsis in neonate is most likely caused by Ecoli, klebsiella, enterobacter and group B streptococci⁽⁹⁾. The source of the infection is an important determinant of clinical outcome. Severe sepsis is likely to occur

in patients with nosocomial pneumonia and intra-abdominal infections. The early institution of antimicrobials has been shown to lower mortality rate. The choice of empirical therapy depends on age and source of infection e.g; for neonatal sepsis a combination of third generation cephalosporin with aminoglycoside is usually used⁽⁷⁾. For CNS infection a combination of vancomycin with third generation cephalosporin or meropenem is very effective.

MATERIAL AND METHOD

This retrospective study was conducted on 450 children age less than 5 years with septicemia admitted at Fatima Memorial Hospital. Gold standard of diagnosis was positive blood culture and antibiotic sensitivity pattern was investigated.

Blood samples were collected after cleaning the venous site with 70% alcohol and providone iodine. The blood cultures were immediately sent to the laboratory where they were incubated at 37°C for seven days. Three subcultures were made; at 72hour, 5TH and 7th day on MacConkey,

Blood and Chocolate agar. The organisms were identified by conventional methods. Antibiotic sensitivity tests were done against locally available antibiotics by using disc diffusion method.

Gram negative bacteria were 63% of total isolates and gram positive were 37%. The commonest gram negative bacterial isolates were E Coli(22%) followed by Klebsiella(11%), acintobacter(9%), pseudomonas (8%), salmonella typhi (6%), salmonella paratyphi (4%) and hemophilus influenza(3%) type B.

RESULTS

A total of 450 blood culture samples were collected. Out of these 30% were cultures positive.

Blood culture results

Gram negative organisms		Gram positive organisms	
E Coli	22%	Staphylococcus aureus	15%
Klebsiella	11%	Staphylococcus epidermidis	10%
acintobacter	9%	Methicillin resistant staphylococcus	7%
Pseudomonas	8%	Pneumococcus	5%
Salmonella typhi	6%		
Salmonella paratyphi	4%		
Hemophilus influenza B	3%		

Drug sensitivity

	Ctx	Cftr	Cef+ sul	Gen	Amk	Amp	Amx + Clv	mem	van	lzd	Cip
E .Coli	+++	+++	++++	++	++	-	++	++++	+	+	++ +
Klebsiella	++++	+++	++++	+	++	+	-	+++	++	-	++
Acintobacter	-	+	++++	-	-	-	-	-	-	--	-
Pseudomonas	-	-	-	-	++	-	-	+++	-	-	-
Salmonella typhi	+++	+++	++	-	-	-	++	++	-	-	++ +
Salmonella paratyphi	++	++++	++	-	-	+	++	++	-	-	++ ++
Hemophilus influenza type B	+++	+++	++++	+	+	-	+	+++	+	++	++ +
Staph. Aureus	+	+	-	-	+	-	+	+	+++ +	+++	+
Staph epi	+++	+++	+++	++	++	++	++++	++++	+++	+++	+
MRSA	-	-	-	-	+	-	-	-	+++ +	+++	-
Pneummococcus	+++	+++	++	+	+	++	++++	++++	+++	+++ +	++

Ctx = cefotaxime Gen = gentamycin Mem = meropenem Van = vancomycin

Cftr = ceftriaxone Amk = amikacin Amp = ampicillin Lzd = linezolid

Cip = ciprofloxacin

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Cef + sul = cefoparazone + salbactum

Amx + clv = amoxicillin + clavulanic acid

+++ = highly sensitive ++ = sensitive + = intermediate sensitive - = resistant

Among the gram positive organisms commonest organisms were staphylococcus aureus (15%), staphylococcus epidermidis(10%), methicillin resistant staphylococcus (MRSA) (7%) and pneumococcus (5%) organisms E Coli and klebsiella were highly sensitive to cefotaxime, ceftriaxone, cefoparazone + salbactum and meropenem. Acinetobacter had maximum sensitivity to cefoparazone+salbactum. Pseudomonas was sensitive to meropenem and amikacin. Salmonella typhi and paratyphi were highly sensitive to cefotaxime, ceftriaxone and ciprofloxacin. Hemophilus influenza type B was most frequently isolated organisms E Coli and klebsiella were highly sensitive to cefotaxime, ceftriaxone, cefoparazone+salbactum and meropenem. Acinetobacter had maximum sensitivity to cefoparazone+salbactum. Pseudomonas was sensitive to meropenem and amikacin. Salmonella typhi and paratyphi were highly sensitive to cefotaxime, ceftriaxone and ciprofloxacin. Hemophilus influenza type B was highly sensitive to cefoparazone+salbactum, meropenem in addition to third generation cephalosporins and ciprofloxacin. Staphylococcus aureus and methicillin resistant staphylococcus were highly sensitive to vancomycin and linezolid. Pneumococcus was sensitive to third generation cephalosporins, amoxicillin+clavulanic acid, meropenem, vancomycin and linezolid.

DISCUSSION

Pediatric sepsis is generally considered to comprise a spectrum of disorders that result from infection by bacteria, viruses, fungi, or parasites or the toxic products of these microorganisms. Early recognition and intervention clearly improves outcome for infants and children with conditions that lead to sepsis.

The spectrum of sepsis ranges from microbial invasion of the bloodstream or intoxication with early signs of circulatory compromise—including tachycardia, tachypnea, peripheral vasodilation, and fever (or hypothermia)—to full-blown circulatory collapse with multiple organ dysfunction syndrome (MODS) and death.

In patients with early-onset neonatal sepsis, *Streptococcus agalactiae*, *Escherichia coli*, *Haemophilus influenzae*, and *Listeria*

monocytogenes are the most frequent organisms encountered.

In patients with late-onset neonatal sepsis, coagulase-negative *Staphylococcus*,^[5] *Staphylococcus aureus*, *E. coli*, *Klebsiella* species, *Pseudomonas aeruginosa*, *Enterobacter* species, *Candida* species, *Sagalactiae*, *Serratia* species, *Acinetobacter* species, and various anaerobes are some of the most commonly involved organisms.

In most infants worldwide, the most frequent causes of bacterial sepsis are *H influenzae* type b (Hib), *Streptococcus pneumoniae*, *Neisseria meningitidis*, and *Salmonella* species. The same pathogens that cause sepsis in infancy also cause it in childhood, although the presence of encapsulated organisms generally becomes less frequent as a child's immune response to polysaccharide antigens improves with age.

In this study spectrum of microbial agents causing septicemia in children was identified in a tertiary care hospital including neonatal sepsis. Both gram positive and gram negative organism were isolated. The most common gram positive organism was staphylococcus aureus followed by staph epidermidis, MRSA and pneumococcus. E coli was the most frequently isolated gram negative organism especially in neonates. Other gram negative isolates were klebsiella, hemophilus influenza type B, pseudomonas and acinetobacter. Empirical therapy for salmonella typhi and paratyphi infection is ceftriaxone (6). Identification of drug sensitivity is important for initiation of appropriate empirical therapy. According to the sensitivity of organisms empirical therapy for neonatal sepsis is third generation cephalosporins along with amikacin. Similarly empirical therapy for nosocomial infections is meropenem and vancomycin.

CONCLUSION

In this study blood cultures were obtained from 450 children aged 0-5 years who presented to a tertiary care hospital with suspected sepsis.

Both gram negative (63%) and gram positive (37%) organisms were isolated and their drug sensitivities were noticed. First line therapy for common gram negative organisms is third generation cephalosporins along with amikacin. For nosocomial infections cefoparazone +

salbactam with amikacin or meropenem along with vancomycin are recommended antimicrobial combinations. Empirical therapy for enteric fever is ceftriaxone or ciprofloxacin. For pneumococcal infections amoxicillin + clavulanic acid is a cost effective antimicrobial. Other recommended drugs are third generation cephalosporins, vancomycin and linezolid. For staphylococcal infections maximum sensitivity is for vancomycin and linezolid

REFERENCES

1. Iregbu K C, Olufumilayo Y E, Iretila B B: Bacterial profile of neonatal septicemia in tertiary hospital in Nigeria. *Africa Health Sciences* 2006;6:151-154
2. S.M. Hanif, Sajid Maqbool, M A Arif, "Infectious Disease" Text book of Pediatrics 5th edition 2011 p.295-331
3. Zulfiqar Ahmed Bhutta, "Salmonella & Non typhoidal Salmonella, Enteric fever" 19th edition Nelson Text book of Pediatrics 2012 p.948-954
4. Ogunleye VO, Ogunleye AO, Ajuwape ATP, Olawole O M, Adetosoye AI : Childhood septicaemia due to salmonella species in Ibadan, Nigeria. *African Journal of Biomedical Research* 2005; 8:131-134
5. James.K.Todd, "Staphylococcus" 19th edition Nelson Text book of Pediatrics 2012 p.903-907
6. Ogunleye VO, Ogunleye AO, Ajuwape ATP, Olawole O M, Adetosoye AI : Childhood septicaemia due to salmonella species in Ibadan, Nigeria. *African Journal of Biomedical Research* 2005; 8:131-134
7. Le Saux N, CPS Infectious diseases and immunization committee Antimicrobial Stewardship in daily practice, Managing an important resource. *Pediatric Child Health* 2014;19(5):261-70
8. David A. Turner and Ira M. Cheifetz, "Shock" 19th edition Nelson Text book of Pediatrics 2012 p.305-313
9. Ralston S, Hill V, Waters A. Occult serious bacterial infections in infants younger than 60-90 days with bronchiolitis : A systematic review . *Arch Pediatr Adolesc Med* 2011;165(10):951-6.