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Bacteremia in children at a regional hospital in Trinidad

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Summary

Objective: The objective of this study was to provide a Trinidadian perspective on pediatric community-acquired and hospital-acquired bacteremia via the documentation of common etiologic agents, antimicrobial profiles of the isolated pathogens, and patient outcome.

Methods: This was a six-year retrospective study of children with bacteremia admitted to the pediatric wards of the San Fernando General Hospital, Trinidad.

Results: Seven hundred and four episodes of pediatric bacteremia were reviewed during the six-year study period. The predominant isolate was *Staphylococcus aureus* (23.9%), followed by *Pseudomonas aeruginosa* (15.5%), *Klebsiella pneumoniae* (12.5%), and *Enterobacter spp* (11.1%). The remaining isolates each accounted for less than 10% of total isolates. The mortality rate was highest for *P. aeruginosa* (39.4%), *Streptococcus pneumoniae* (22.5%), and *Escherichia coli* (19.2%). Of the six cases due to *Neisseria meningitidis*, only two survived. The overall mortality rate for the study period was 15.1%, but varied considerably according to age. All deaths due to *P. aeruginosa* and *E. coli* occurred in neonates. Almost 90% and about half of all *S. aureus* were resistant to ampicillin and erythromycin, respectively; nineteen (11.3%) were methicillin-resistant. More than 95% of *K. pneumoniae* and more than 87% of *Haemophilus influenzae* were resistant to ampicillin. Group B streptococci were fully susceptible to ampicillin and amoxicillin–clavulanic acid, but showed >90% and >70% resistance to tetracycline and trimethoprim–sulfamethoxazole, respectively. Of the 40 strains of *S. pneumoniae* isolated, 10.0% had a minimum inhibitory concentration (MIC) ≥ 4 $\mu\text{g}/\text{mL}$ (resistance) and 12.5% had a MIC = 2.0 $\mu\text{g}/\text{mL}$ (intermediate resistance) to ceftriaxone, while 7.5% showed intermediate resistance (MIC between 0.12 and 1 $\mu\text{g}/\text{mL}$) and 25.0% showed resistance (MIC ≥ 2 $\mu\text{g}/\text{mL}$) to penicillin.

Conclusion: The bacteremia rate was found to be 8.4% among hospitalized children suspected of having sepsis and from whom a blood culture was positive. Bacteremia was also associated with a high mortality rate of 15.1%. An unusually high level of bacteremia with Gram-negative enteric

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bacteria was seen, which might indicate cross infection and reflect a breakdown in infection control measures. Relatively high-level resistance of *S. pneumoniae* to penicillin and ceftriaxone was not seen, even though the overall prevalence of resistance to other antibiotics among other pathogens was relatively low. The drugs that showed the greatest efficacy were imipenem, gentamicin, ciprofloxacin, and the cephalosporins ceftazidime and ceftriaxone.

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Introduction

Bacterial isolation from blood specimens is often associated with high morbidity and mortality, particularly among children.^{1–3} Many studies on the incidence of blood stream infections have shown an increased occurrence over the past 15–20 years due to the increasingly vulnerable patient population being admitted to hospitals.^{1,4} Patients at particular risk for bacteremia include those less than five years of age,^{1,5} those with severe underlying disease,^{6–9} the malnourished,¹⁰ and those with severe burns and admission to an intensive care unit.^{11–13} The majority of pediatric bacteremia cases are caused by a number of common pathogens that include *Streptococcus pneumoniae*, group B streptococci (GBS), *Haemophilus influenzae*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, and *Enterobacter spp.*,^{1,4,7,14} and the predominant etiologic agent may vary from one geographical area to another, and even within a given area.^{6,7,12,13} Different organisms may have different antimicrobial susceptibilities and successful treatment is dependent upon the prompt administration of the correct drug.^{8,14} There is at present a scarcity of Trinidadian and regional data on bacteremia in pediatric patients.

The present study was undertaken to provide a Trinidadian perspective to bacteremia by documenting the distribution of organisms responsible for episodes of bacteremia in children admitted to the San Fernando General Hospital. Particular emphasis was placed on the underlying diagnosis of both community-acquired and hospital-acquired bacteremia, the suspected source of infection, risk factors, and outcome. Through the antimicrobial profile, the study provides a rational basis for empiric choices of drugs in suspected cases of bacteremia while awaiting results of blood culture.

Patients and methods

Study population

All children from birth to 12 years of age, admitted to the pediatric wards of San Fernando General Hospital from January 1, 1997 to December 31, 2002 were eligible for the study. The San Fernando General Hospital is a 650-bed tertiary teaching hospital with a daily census of about 800 and a monthly admission rate of about 1800 patients. The hospital serves the southern area of the country that has a population of approximately 410 000 people; the total population of the country is about 1.3 million. Trinidad is 4828 square kilometers in area and is the larger of the twin island republic, Trinidad and Tobago, located about 11 kilometers off the northern coast of Venezuela in South America.

Case studies

Case records of all hospitalized children whose blood cultures grew any organisms during the study period were reviewed retrospectively. There are four pediatric wards (two surgical and two medical) with 128 beds divided among them. The neonatal unit has 40 beds. Records were kept of patient age, sex, weight, duration of hospital stay, working diagnosis, and previously diagnosed underlying illness. Also recorded were the results of each positive blood culture and specimens taken from other body sites at the same time as the blood culture. White blood cell (WBC) and differential cell counts, highest body temperature on the day the blood culture was taken, and antimicrobial therapy before and after blood culture results were known, were also recorded.

Blood culture

A positive blood culture was considered significant if the same organism was isolated from another specimen source from the same patient or if the blood isolate was compatible with the clinical diagnosis. Isolated organisms such as *Neisseria meningitidis*, *H. influenzae*, *S. pneumoniae*, GBS, *E. coli* and other Gram-negative bacilli of the *Enterobacteriaceae* family, viridans streptococci, *S. aureus*, and *P. aeruginosa* were considered significant. Organisms were considered contaminants if they were only isolated from a single blood culture and the patient recovered without being treated with any antimicrobial agents by the physician. *Bacillus spp.*, diphtheroids, and coagulase-negative staphylococci were among organisms often considered as contaminants and these cases were not included in the study.

The pediatrician took blood specimens for culture after sterilizing the skin with 70% alcohol and then with 10% povidone iodine solution. One to three milliliters venous blood was taken from the patient and inoculated into an aerobic blood culture bottle (Bactec Peds Plus/F, Becton Dickinson, Microbiology Systems, Cockeysville, Maryland, USA). No note was taken as to whether the above aseptic measures were strictly adhered to in every sample taken. All cultures were checked daily for cloudiness, hemolysis, and gas production. Sepsis was defined according to the recommendations of Bone et al.¹⁵

Organisms were identified via standard microbiological techniques and susceptibility testing was evaluated using the disc diffusion methods according to the guidelines of the National Committee for Clinical Laboratory Standards (NCCLS).¹⁶ The following antibiotics and concentrations (in brackets) were used: ampicillin (10 µg), amoxicillin–clavulanic acid (20/10 µg), tetracycline (30 µg), erythromycin (15 µg), cefuroxime (30 µg), imipenem (10 µg), ceftriaxone (30 µg), ceftazidime (30 µg), vancomycin (30 µg), gentami-

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