BACTEREMIA AND BACTERIAL INFECTIONS IN HIGHLY FEBRILE CHILDREN WITHOUT APPARENT FOCUS

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ABSTRACT

To find the incidence of bacteremia and serious bacterial infections in febrile children without an apparent focus of infection, we prospectively studied 100 febrile children aged 1 month-3 years with a rectal temperature ≥39°C. Ten children had a blood culture positive bacteremia and nine had serology positive for bacteremia; 6 had urinary tract infection, 5 otitis media and 8 meningitis. A diagnosis of non bacterial illness was made in 62 patients. Staphylococcus aureus was the most common bacteriologic isolate on blood culture (five) and by serology (eight). TLC ≥15,000/cu mm m-ESR ≥25 mm and temperature ≥39°C had high specificity (95-100%) but low sensitivity for diagnosis of bacteremia.

Key words: *Bacteremia, Febrile Child, Staphylococcus aureus.*

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A febrile child without an identifiable focus of infection is a diagnostic and management challenge. In an emergency room, the management objectives remain recognition of children who may have bacteremia or serious bacterial infections, and initiate empiric antibiotic therapy in suspected cases. Since a microbiologic diagnosis is delayed till 24-48 hours, to achieve the objectives it is necessary to know the pattern of pathogens causing bacteremia and bacterial infections and identify simple tests which can help in making an early presumptive diagnosis in a given set-up. Various acute phase reactants have been studied for their value in diagnosing bacteremia and bacterial infections(1-5). Studies have noted that temperature >39°C and a WBC count >10,000/mm^3 could predict bacteremia in only 5% cases but excluded 95% non-bacteremic children(1,2). Erythrocyte sedimination rate(ESR) has shown higher sensitivity and specificity than the above parameters(3,4).

The objectives of this study were to find: (*i*) the prevalence and causative organisms of bacteremia and bacterial infections in febrile children without an identifiable focus of infection attending, the Pediatric Emergency Service, and (*ii*) the usefulness of total leucocyte count(TLC), absolute neutrophil count(ANC) and micro-ESR (m-ESR) in early diagnosis of bacterial infection.

Material and Methods

This prospective study was conducted over a period of one and half years (from January, 1989 to July, 1990). The study sample comprised 100 febrile children which were brought to our Pediatric Emergency Service for fever of ≤3 days duration. Only those children who had an axillary temperature of more than 38.5°C (or

rectal ≥39°C), without any apparent focus of infection on history and physical examination, a normal chest X-ray and a peripheral blood film negative for malaria parasite were included. Patients with a neoplastic and immunosuppressive disease, chronic diseases such as nephrotic syndrome, liver disease or heart disease and those who had received prior antibiotic therapy were excluded.

A detailed history and physical examination were done at admission. Venous blood was obtained for TLC, DLC, mESR, and serology and culture by standard methods. Urine culture, and CSF analysis and culture were done in all the infants below one year and in older children wherever indicated. In the hospital, daily physical examination was done and progress noted. All the management decisions were made by the treating physicians and were independent of the study.

TLC was performed by the standard method using hemocytometer, while DLC was performed by counting at least 100 WBCs on a Leishman stained peripheral blood film. Micro ESR (mESR) was determined by using a preheparinised microhematocrit tube with an internal diameter of one millimeter. For serological diagnosis of pneumococcus and *H. influenzae,* Counter Current Immunoelectrophoresis (CCIEP) was performed by the standard technique using specific antiserum while latex agglutination test was used for *Staphylococcus aureus.*

On the basis of the final diagnosis the data was divided into three groups; Group one–bacterial infection, Group two–presumed bacterial infection and Group three–non-bacterial febrile illness. The group with bacterial infections was further subdivided into bacteremia (blood culture +ve or serology +ve) and urinary tract infection (UTI-urine culture +ve). Presumed bacterial infection included otitis media and pyomeningitis. The diagnosis of pyomeningitis and otitis media was not apparent at the time of admission but was arrived at, respectively after CSF analysis (polymorphonuclear pleocytosis, hypoglycorrhachia, and elevated proteins) and clinical examination on follow up. Children with non-bacterial illness were those whose blood, urine and CSF cultures were sterile and the serological tests were negative.

Statistical Analysis

The means and standard deviations, were calculated for TLC, ANC, m-ESR, and temperature within various groups, and compared by 't' test. Specificity, sensitivity and predictive values (PV) of the above tests were computed for their ability to discriminate children with bacteremia.

Results

The study population comparised 55 boys and 45 girls. Their mean ± SD age was 11.7 ± 8.5 months. Sixty three patients were below one year, 30 were 12-23 months of age and 7 were above 24 months.

The final diagnoses arrived at in the study patients are shown in *Table I. S. aureus* was the most common etiologic agent of bacteremia on blood culture and serology. *E. coli* was the commonest agent in UTI. Bacteriological diagnosis could not be made in any of the patients with otitis media or pyomeningitis.

Table II shows the mean ±SD of TLC, ANC, mESR, and temperature in various groups. The mean mESR in patients with bacteremia (culture +ve and serology +ve) was significantly higher than that of otitis media or UTI. However, a clear diag-

TABLE I— *Final Diagnosis of 100 Highly Febrile Children Without Apparent Focus Attending the Pediatric Emergency Service*

(A) *Proven bacterial infection*	
(1) Bacteremia (positive blood culture)	10
Staphylococcus aureus	5
Acinetobacter species	2
Salmonella typhi	1
Salmonella typhimurium	1
Klebsiella pneumoniae	1
(2) *Bacteremia (serology +ve)*	9
Staphylococcus aureus	8
Haemophilus influenzae	8
(3) Urinary tract infection (urine culture +ve)	6
Escherichia coli	5
Klebsiella pneumoniae	1
(B) Presumed bacterial infection	13
Pyomeningitis	8
Otitis Media	5
(C) Non bacterial illness	62

nostic cut-off point could not be identified for m-ESR when individual values among bacteremic patients and those with the localized infection were compared.

The group of 62 patients with no evidence of bacterial infection by microbiologic and serologic studies had a mean age of 11.6 months (SD–8.0 months) and a male-female ratio of 1:2. The mean (±SD) TLC, ANC, m-ESR in this group were significantly lower than the bacteremia group (*Table II*). None of the patients in this group had a TLC ≥15,000/mm^3; 3% (2 patients) had an mESR ≥25 mm/I h and 5% (3 patients) had an axillary temperature ≥39.0°C.

TLC ≥15,000/mm^3, mESR ≥25 mm/I h and temperature ≥39.0° had a good specificity (100, 97 and 95%, respectively) but a poor sensitivity (26, 63, and 32%, respectively). mESR ≥25 mm had the best combination of positive (86%) and negative predictive values (90%). This was followed by TLC (+ve PV 100%, -ve PV

TABLE II— *Mean ± SD TLC, ANC, ESR and Temperature of Febrile Children with Bacteremia, Bacterial Infections and Nonbacterial Illnesses*

Group	TLC (/mm^3)	ANC (/mm^3)	mESR (mm I h)	Temperature (°C)
Culture +ve bacteremia	10920* ±5439	6983 ±4170	24.0 ±6.7*	38.8 ±0.3
Serology +ve bacteremia	10587* ±4516	6830 ±3418	19.6 ±11.3*	38.7 ±0.2
Urinary tract infection	10800* ±2545	6735 ±2077	13.6 ±9.4	38.8 ±0.1
Otitis media	9760 ±4013	5506 ±3794	7.6 ±5.5	38.8 ±0.1
Pyomeningitis	11950* ±6235	7532 ±5329	21.2 ±10.3*	38.7 ±0.2
Nonbacterial illnesses	7778 ±2405	4340 ±2035	9.0 ±7.0	38.8 ±0.15

*$p<0.05$.

82%), and temperature ≥39° (+ve PV 66%, -ve PV 82%).

Discussion

We found that 10% of febrile children without an apparent focus of infection had bacteremia. An additional 9% had evidence of bacterial infection on serological tests. This is almost twice that has been reported in the American population(1,6). The prevalence in the studies conducted by Teele was 3.9% while in that by McCowan 4.3%. One reason for this difference could be inclusion of children with a rectal temperature of ≥38.3°C by the authors of the above studies. McLellan had shown that the incidence of bacteremia with rectal temperature >39°C is more than twice than with the temperature <39°C(7).

The most important findings of this study is a high incidence of staphylococcal bactermia in febrile children without an apparent focus of infection. Not only 50% of all positive bacterial cultures grew *S. aureus* but also the staphylococcal antigen was detected in 8 out of 9 serologically positive bacterial infections. This is in sharp contrast to American studies on the subject in which *Streptococcus pneumonae* and *H. influenzae* were the commonest pathogens(1,3). The finding implies that empiric antibiotic therapy must include antistaphylococcal agents in our setting in a febrile child without apparent focus of infection. We found mESR≥25 mm/I h highly specific for bacterial infection with a sensitivity of 62%. It had a negative predictive value of 90% which is similar to that reported by McGowan(1) and Teele(2). McCarthy(3) found that in febrile children, an ESR ≥30 mm was more sensitive to discriminated bacteremia. Putto(5) also found ESR ≥30 mm/I h to be the most sensitive (91%) and specific (89%) indicator of bacterial infection.

TLC ≥15,000/cu mm and rectal temperature >39°C or higher had a high specificity but a low sensitivity. Teele and McCowan have noted similar results in their studies of occult bacteremia(1,2). McLellan had commented that the absence of leucocytosis is an excellent discriminator of bacteremia, while its presence is a poor indication of bacteremia(13).

Thus to conclude, we found that bacteremia was present in 10% and proven bacterial infections in 25% of all febrile infants and children (1 months to 3 years) without an apparent focus of infections. *S. aureus* was the commonest pathogen of bacteremia. Choice of empiric antibiotic therapy in suspected bacteremia should therefore include antistaphylococcal agent if a decision to use antibiotics is made in these children. TLC ≥15,000/mm^3, mESR ≥25 mm and temperature ≥39°C are highly specific (95-100%) to rule out bacteremia, but are not sensitive enough to indicate its presence.

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NOTES AND NEWS

SECOND NATIONAL CONGRESS OF INDIAN SOCIETY FOR PRENATAL DIAGNOSIS AND THERAPY

The Second National Congress of Indian Society for Prenatal Diagnosis and Therapy is to be held from *February 19 to 21, 1993* at the All India Institute of Medical Sciences, New Delhi 110 029.

Scientific Programme

Workshop (February 19-20): On Obstetrical Techniques and Laboratory Diagnosis of Fetal Sex, Chromosomal and Biochemical Disorders plus Thalassemia and Muscular Dystrophy.

Congress (February 20-21): Guest lectures by leading International and National experts. Plus free papers and posters.

Post Congress Training Course (February 22-25): Genetic Counselling, Biochemical and Molecular Genetic Techniques.

Organizing Secretary: Dr. I.C. Verma, Genetic Unit, Department of Pediatrics, Old Operation Theatre Building, All India Institute of Medical Sciences, Ansari Nagar, New Delhi 110 029.

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