



Gram-Positive Bacteremia in Febrile Children under two years of Age

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Abstract

*This study aimed to investigate gram-positive bacteremia in febrile children according to some risk factors and to detect the types causative bacteria. One hundred sixty blood samples were collected from children under 2 years who were suffering from fever and admitted to emergency department of Babylon Maternity and Children Hospital in Hilla. The results indicated that 31(19.4%) blood samples revealed positive cultures consisting of 21(68%) gram-positive bacterial isolates and 10(32%) gram-negative isolates (Gram-negative isolates are not fully discussed in this paper). Gram-positive isolates represented by; *Staphylococcus aureus* which accounted for 10(33%), *Coagulase negative Staphylococci (CoNS)* which accounted for 5 isolates(16%), *Streptococcus pyogenes* 4 isolates(13%), *Listeria monocytogenes* and *Micrococcus sp.* 1 isolate(3%) for each. The results showed that; infants under one months of age were more susceptible for bacteremia than other ages, in a rate of 32.5%.*

Keywords: Febrile children, Bacteremia, Gram-positive bacteria.

Introduction

Bacteremia is the presence of viable bacteria in the circulating blood. Bacteria may enter the blood stream giving rise to bacteremia from an existing focus of infection from a site with the commensally flora or by direct inoculation of contaminated materials into the vascular system. These organisms are often cleared from the blood within minutes, so the bacteremia is silent and transient, but if the immune system is overwhelmed or evaded, organisms persist in the blood and bacteremic symptoms would arise. Bacteremia should be distinguished from septicemia in which signs and symptoms of severe diseases are present¹.

Patients with occult bacteremia do not have clinical evidence other than fever of a systemic response for infection. Bacteremia may also occur in children with focal infection or in children who have sepsis. Bloodstream infections continue to be the major cause of morbidity and mortality despite advance in antimicrobial therapy and supportive care². Fever in infants younger than 1 year old, especially those younger than 3 months, can signal a serious infection³.

Because bacteremia in children has different implications and different patterns than that in adults⁴ and because children bacteremia is not quite enough investigated in Babylon province, consequently, this work has been suggested in attempt to project the light on this problem. The main goals of this study are; to estimate the incidences of gram-positive bacteremia in infants around Babylon province and to determine the risk factors such age, sex and residence in bacteremic infections in children.

Material and Methods

Samples: One hundred sixty blood samples were collected from infants below 24 months who were referred to maternity and children teaching hospital in Hilla suffering from fever (axillary > 38.3). One ml. venous blood samples were collected in screw capped tubes containing supportive media 910 ML. Brain Heart Infusion broth-BHIB without anticoagulant materials.

Collection of samples: The blood samples were collected from infants under aseptic conditions according to Fischbach F.⁵ The blood samples were inoculated into culture bottle contained BHIB and transferred immediately to the laboratory to incubate it at 37 C for 2-7 days.

Laboratory tests: After incubation period, the signs of growth appeared in the blood culture, e.g. turbidity, gas and flocculation, then 0.1 ml. was taken from this culture to proceed the routine, diagnostic tests of *Staph. aureus*, e.g. gram staining for full cellular morphology, mannitol fermentation, coagulates test (tube method) and blood hemolysis.

Statistical analysis: Data were analyzed by X²- test and Z-test, $p= 0.05$

Results and Discussion

The results shown in figure-1 indicate that 19.4% (31/160) of the total children being investigated in this study were bacteremic, since they revealed positive results for blood culture, while 80.6% (129/160) revealed negative results (no growth).

Figure-2 below, shows the ratio of gram-positive to gram-negative. Gram-positive bacteria accounted for 68% (21/31) versus 32% (10/31) of gram-negative.

Figure-3 shows the types and frequency of bacterial isolates being detected in blood samples consisting gram-positive bacteria represented by *Stph. aureus* 10 isolates (33%), CoNS 5 isolates (16%), *Strep. pyogenes* 4 isolates (13%), *Listeria monocytogenes* 1 isolate (3%) and *Micrococcus* sp. 1 isolate (3%), while gram-negative bacteria constituted a total of 10

isolates (32%). (Further details for gram-negative bacteria are not shown in this paper).

The distribution of bacteremic infection according to age is presented in figure-4. The results showed, that bacteremia incidences were more in infants <1 month than in other age groups. The data analysis showed no significant relation of total gram-positive and gram-negative bacteremia and gram-positive bacteremia with age factor. ($p > 0.05$), X2 calculator (total) =4.8, X2 calculator (gram-positive) = 5.5, X2 table = 9.4.

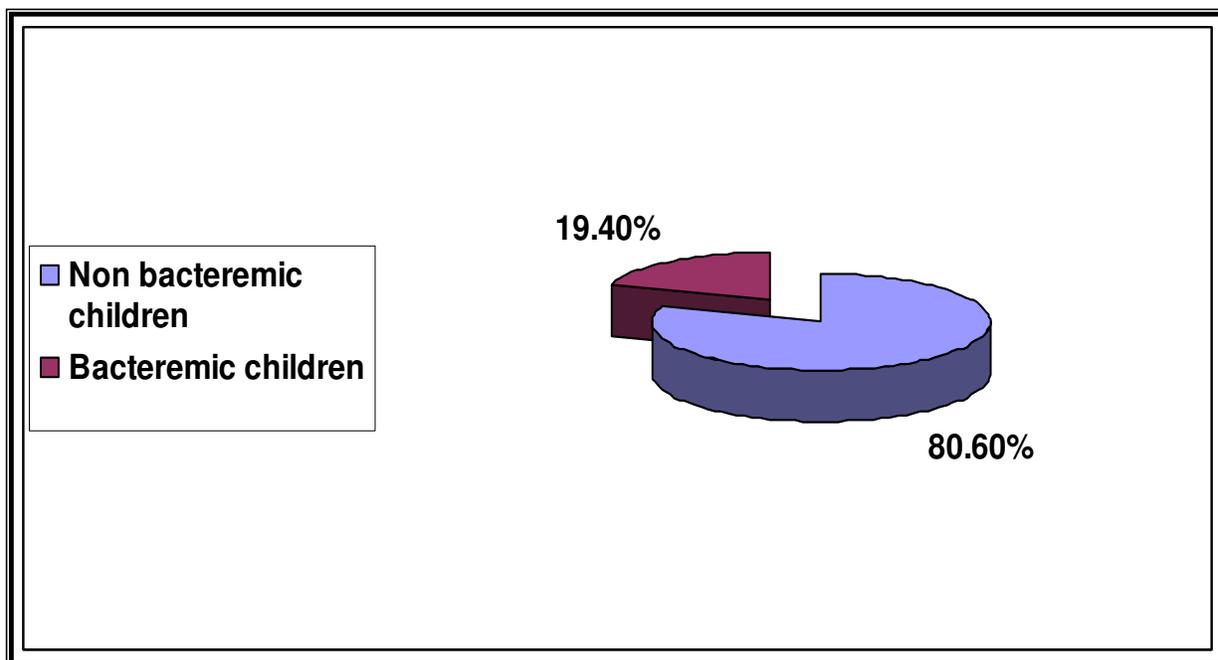


Figure-1
Rate of bacteremia in febrile children included in this study

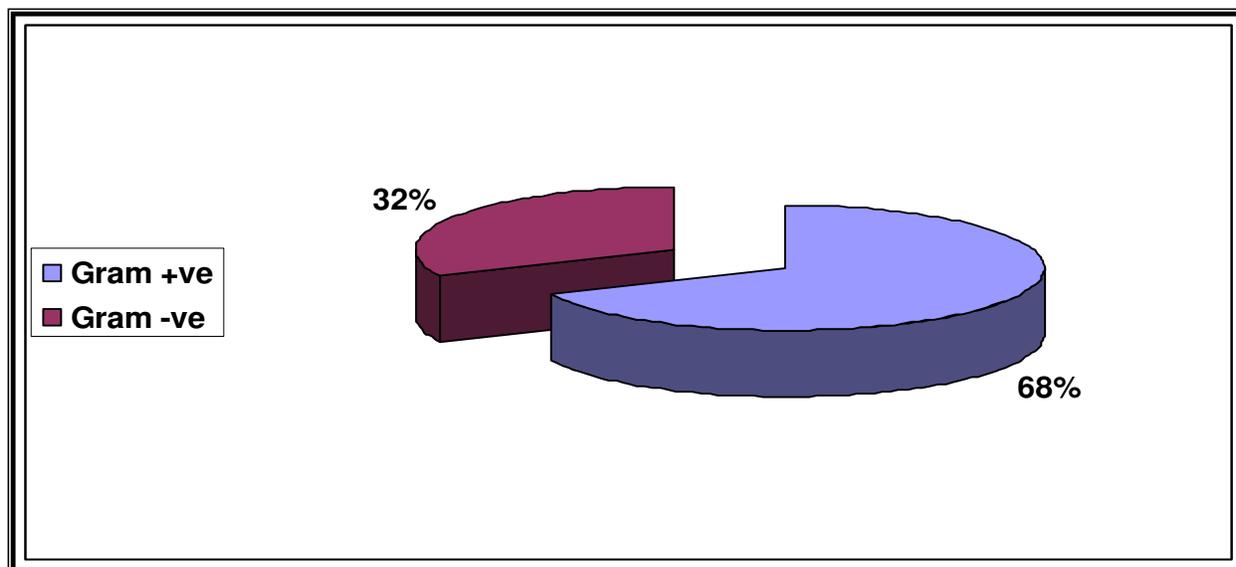


Figure-2
Ratio of gram-positive to gram-negative isolates detected in bacteremic children

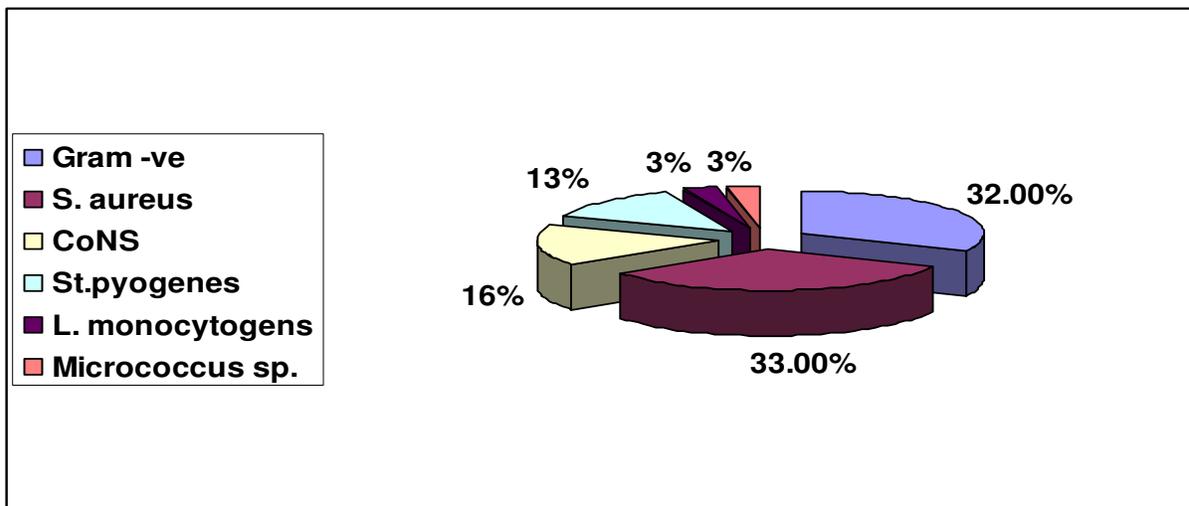


Figure-3
 Types and percentage of bacterial isolates from blood samples of bacteremic children

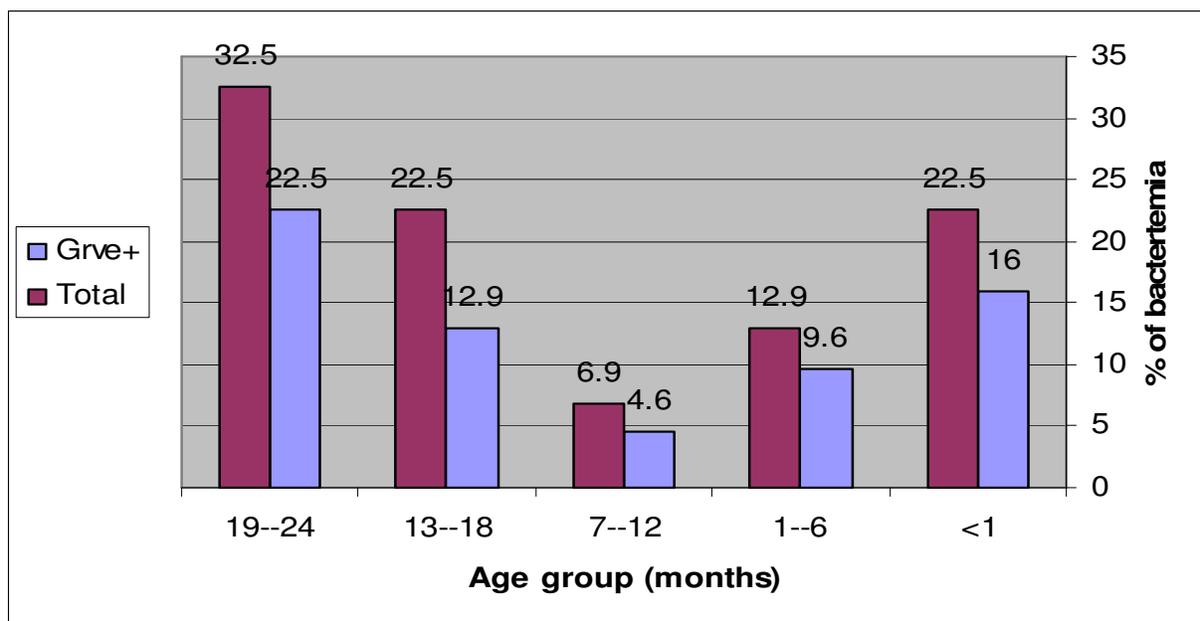


Figure-4
 Distribution of bacteremic infection according to age/months

The study found that 61 febrile children (19.4%) have bacteremia (figure-1). This result agrees with⁶ who stated that the rate of bacteremia among infants aged 1 to 3 months was (23%) in Najaf, Iraq but it is higher than an American study⁷ which found that the rate of bacteremia in children aged 1-24 months was (7.7%). This variation may be related in part to differences in samples size, to the population studied and/or to environmental factors. The cause of fever in the remaining febrile children (80.6%) may due to non bacterial causes, where most of the investigated young children with fever had no focus of infection presented with a self limiting viral illness⁸.

In this study, 31 febrile children were bacteremic being caused by both; gram-positive 21 (68%) and gram-negative 10 (32%) as shown in figure-2. This result was in accordance with that results being obtained by Berner et al⁹ who reported that the percentages of gram-positive and gram-negative bacteria isolated from bacteremic children were 71% and 29% respectively. However, the results were in contrast with local study by Shams A.L. et al⁶ who found that gram- negative bacteria isolated from bacteremic children were more than gram-positive. Variable results are expected in such studies and the variation can be attributed to various risk factors represented by children's age, gestational age, body weight, education and hygienic conditions.

Staph. aureus was predominant among gram-positive isolates which accounted for (33%) out of all isolates (figure-3). Bacteremia due to *Staph. aureus* in children continues to carry a significant mortality on admission¹⁰, because this organism is more invasive among gram-positive bacteria and an important pathogen that leads to fatal bacteremia. This can be ascribed to its virulence factors and its ability to resist many antibiotics particularly Methicillin Resistant *Staph. aureus* (MRSA), which facilitates its widespread in environment and hospitals¹¹.

Coagulase negative staphylococci (CoNS) appear to be the major pathogen worldwide and associated with significant morbidity and mortality in neonates and infants. These organisms are considered as the most common organisms associated with infantile bacteremia. In this study, CoNS represented the second pathogen among gram-positive isolates (16%) of all isolates (figure-3), which is in consistency with an Indian authors¹² who reported that CoNS incidences in infants with septicemia was (16.3%). The reasons for an increasing rate of CoNS may be related to the use of broad spectrum antibiotics and to the role of specific adherence and slime produced by CoNS¹³.

Streptococcus pyogenes accounted for (13%) as shown in figure-3. With this respect, it has been reported by Abuhammour W. et al¹⁴ that the incidences of bacteremia in children due to this organism ranged from 0.5 to 2.0%. The rate of bacteremia due to this organism has risen; theories to account for the apparent increase in incidence and severity have involved possible changes in susceptibility of this group to antibiotics as well as changes in the virulence factors of the organism itself¹⁵.

Micrococcus spp. can be found as normal inhabitants of human skin and mucous membranes and usually regarded as contaminants in clinical specimens, but it may cause many life-threatening infections in addition to bacteremia such as endocarditis, central nerve system infection, peritonitis and pneumonia¹⁶. In this study, *Micrococcus* spp. was found to account for (3%) as shown in figure-3. This organism has been also isolated elsewhere¹⁷ from pneumonic infants in a frequency of 8.7%.

Listeria monocytogenes in this study was also found to be implicated in infant's bacteremia. It accounted for (3%) out of all isolates as indicated in figure -3 and was found only in neonates. The group of Ako-Nai¹⁸, 1999 isolated *Listeria monocytogenes* from septicemic neonates in a percentage of (8.4%). However, the results presented in this study revealed low prevalence of neonatal listeriosis in relative with the study mentioned above. This can be attributed in part to hygienic policy, feeding regulation and industrial clean-up efforts.

Older and newer reports stated that the incidences of bacteremia in febrile infants are quite varied according to the age. All children being investigated in this study were under 2 years. This age group seems to be more liable for bacteremia, simply

because they have a low immunoglobulin-G antibodies response to encapsulated bacteria¹⁹. The results indicated that the frequency of bacteremia in infants of less than one month old was more than other age groups, since it accounted for a total of 32.5% (figure-4), which goes with Pantell²⁰ who found that bacteremia occurred with greatest preponderance in infants younger than 1 month. This relatively high overall rate of bacterial diseases in this age group is likely to be related to the lower level of immunocompetence in younger infants²¹.

The results indicated that 22.5% of children having bacteremia were 1-6 months of age. It has pointed out that infants aged 3 to 24 months with fever and no major source of infection were at highest risk for occult bacteremia (OB)²². Infants aged 7 to 12 months represented a rate of 6.9% of bacteremia. This is in accordance with⁷ who reported that only (6.2%) of bacteremia was detected among infants aged 7 to 12 months. Infants of such range of ages have been reported to have less risk for developing bacteremia because they are immune competent than that of lower age groups²³. The frequency of bacteremia in children aged 19 to 24 months was 22.5%. The increased incidences of bacteremia in children among such age may due to daily mobility of child, reaching and catching contaminated materials. However, no significant difference between age groups and the rate of bacteremia was found in this study ($P > 0.05$).

Conclusion

All children under 24 months of age are at higher risk for bacteremia. Both, gram-positive and gram-negative are frequently associated with this illness. *Staphylococcus* spp. are predominant in infant bacteremia.

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