

# Gram-Positive Bacteremia in Febrile Children Under Two Years of Age in Babylon Province.

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**Abstract:** This work, mainly aimed to investigate gram-positive bacteremia in febrile children according to some risk factors and to detect the type of causative bacterial agents. One hundred sixty blood samples were collected from children under 2 years old 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-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%. Males were found to be more susceptible than females, since the rates of infection were 52% and 48% respectively, with no significant correlation.

## 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 present (Campbell and Mclutosh, 1998).

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 care (Al-Waznee, 2001). Fever in infants younger than 1 year old, especially those younger than 3 months, can signal a serious infection (Torpy, *et. al.*, 2004).

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\* Data for gram-negative organisms are not fully shown in this paper.

Because bacteremia in children has different implications and different patterns than that in adults (Grandsen, *et. al.*, 1994) 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:

- 1- Estimation the incidences of gram-positive bacteremia in infants of Babylon province.
- 2- Determination the role of some risk factors such as age, sex and residence in bacteremic infections in children.

### Material and methods:

**Samples:** One hundred sixty blood samples have been collected from infants below 24 months who were referred to Babylon Maternity and Children 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 according to Fischbach (2000) under aseptic conditions. 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 the incubation period, the signs of growth appeared in the blood culture, e.g. turbidity, gas and flocculation. 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 and blood hemolysis.

**Statistical analysis:** Data were analyzed by  $X^2$ - test and Z-test,  $p= 0.05$ .

**Results:** 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) had not.

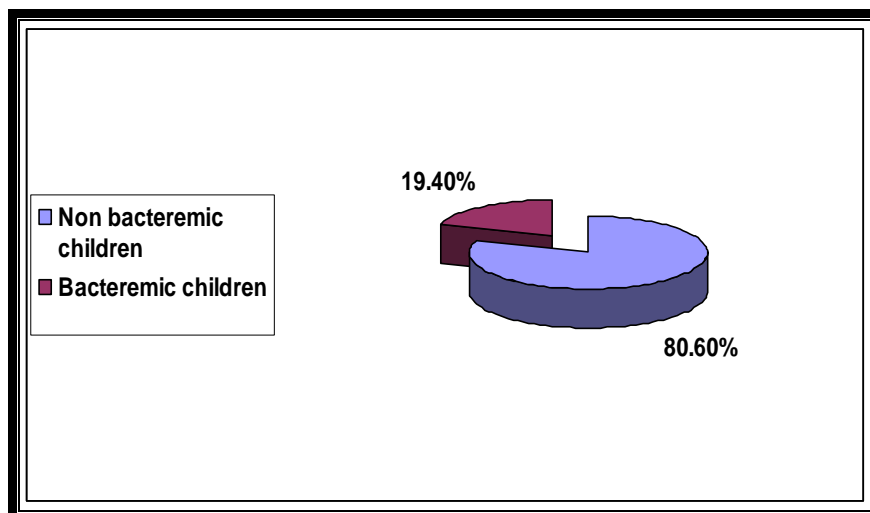


Figure-1: Rate of bacteremia in febrile children.

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

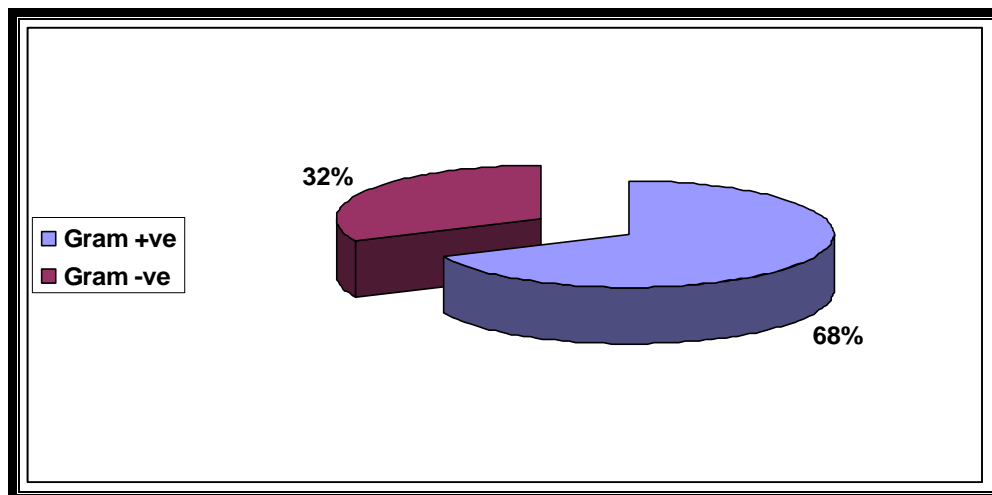


Figure -2: Rate of gram-positive to gram-negative isolates.

Figure-3 shows the types of and percentage of bacterial isolates being detected in blood samples which consist of gram-positive bacteria represented by *Stph. aureus* 10 (33%), *CoNS* 5(16%), *Strep. pyogenes* 4 (13%), *Listeria monocytogenes* 1(3%) and *Micrococcus* sp. 1 (3%), while gram-negative bacteria constituted 10(32%) but were not fully diagnosed as they are not the main subject of this study.

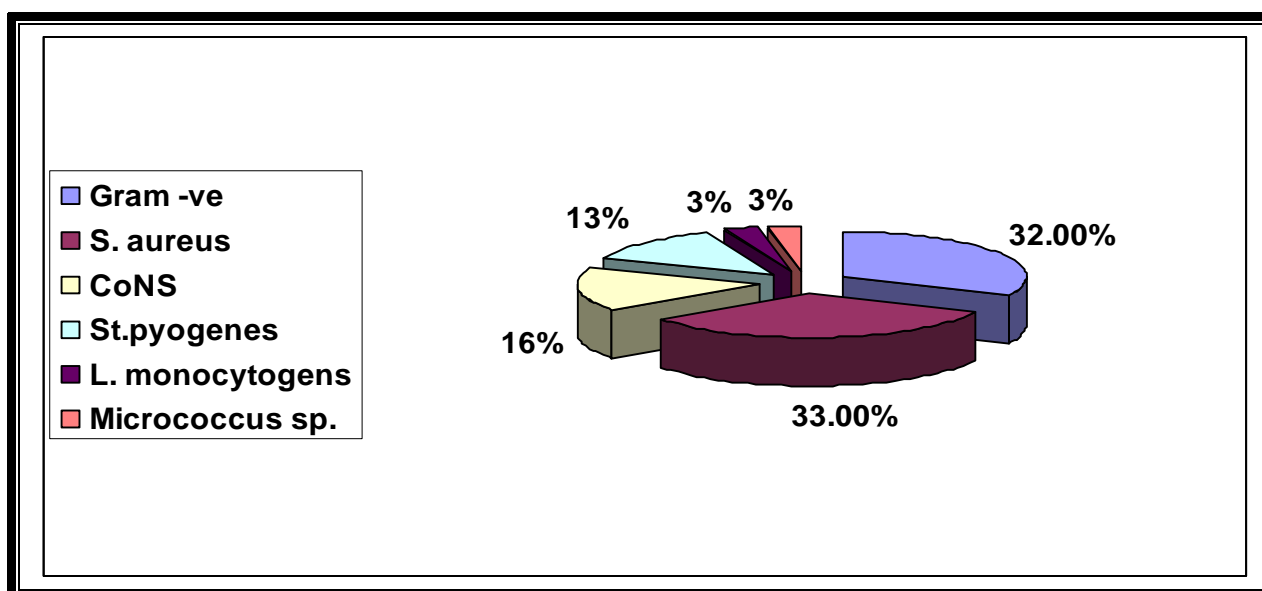


Figure-3: Types and percentage of bacterial isolates from blood samples of bacteremic children.

The distribution of bacteremic infection according to age is presented in figure-4. The results showed, that bacteremia was 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.

( $p > 0.05$ ).  $\chi^2$  calculator (total) = 4.8       $\chi^2$  calculator (gram-positive) = 5.5  
 $\chi^2$  table = 9.4

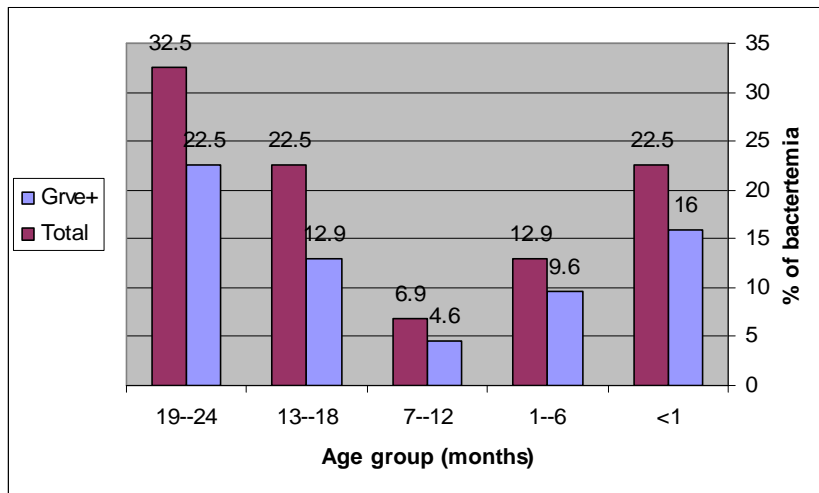


Figure-4: Distribution of bacteremic infection according to age/months

The relation with the sex as a risk factor is indicated in figure-5. There is no significant difference between gram-positive bacteremia and sex factor ( $p > 0.05$ ).  $Z$  calculator = 1.06.  $Z = 1.96$ .

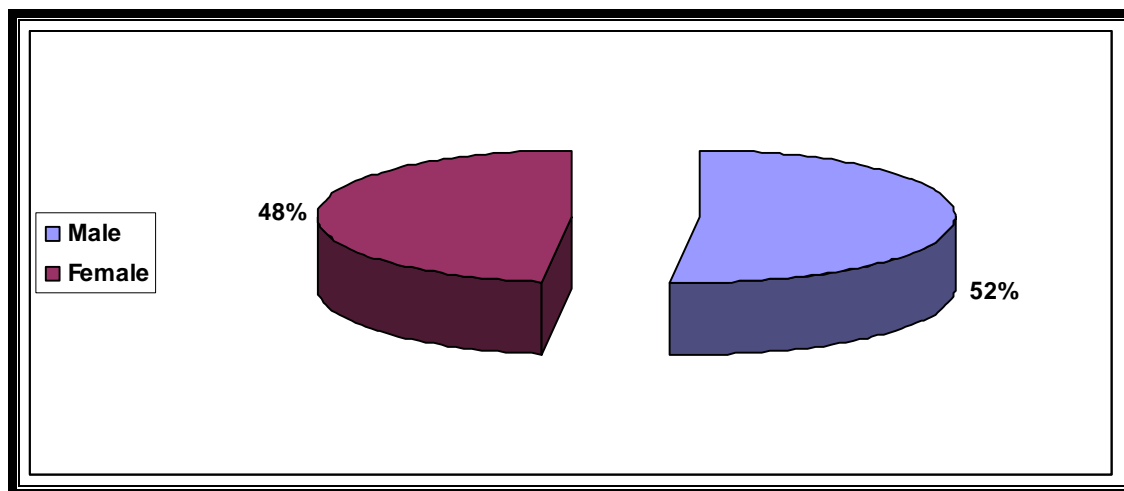


Figure-5: Distribution of gram-positive infection according to the sex.

### Discussion:

The study found that 61 children (19.4%) have bacteremia (figure-1). This result agrees with Shams AL-Deen (2001) who stated that the rate of bacteremia

among infants aged 1 to 3 months was (23%) in Najaf, but it is higher than an American study (Liu, *et.al.*,1985) 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 be non bacterial causes, where most of the investigated young children with fever had no focus of infection presented with a self limiting viral illness (Brook, 2003).

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 and colleagues (1998) 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 (Shams AL-Deen, 2001) 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%) from all isolates (figure-3). Bacteremia due to *Staph. aureus* in children continues to carry a significant mortality on admission (Ladhani, *et. al.*,2004), 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 the many antibiotics particularly Methicillin Resistant *Staph. aureus* (MRSA), which facilitate it's widespread in environment and hospitals (Mukonyora, *et. al.*, 1985).

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 agreed with an Indian study (Jain *et. al.*, 2004) which found that CoNS 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 CoNS (Kloos and Bannerman, 1994).

*Streptococcus pyogenes* accounted for (13%) from all isolates (figure-3). With this respect, it has been reported that the incidences of bacteremia in children due to this organism ranged from 0.5 to 2.0% (Abuhammour, *et. al.*, 2005). 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 the population as well as changes in the virulence of the organism it's self ( American Academy of Pediatrics, 1998).

*Micrococcus* spp. Can be found as normal inhabitants of human skin and mucous membranes and is 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 pneumonia (Eiff, *et.al.*, 1995). In this study, *Micrococcus* spp. was found to account for (3%) as shown in figure-3. This organism has been also isolated elsewhere from pneumonic infection in infants in a frequency of 8.7% (AL-Hamawandi, 2005).

*Listeria monocytogenes* in this study was also found to be implicated in infant's bacteremia. It accounted for (3%) from all isolates as indicated in figure -3 and was found only in neonates. Ako-Nai, *et. al.*, (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 to aggressive food 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 bacteria (Baker and Bell, 1999). The results indicated that the frequency of bacteremia in infants of less than 1 month old was more than other age groups, since it accounted for 32.5% (figure-4), which goes with Pantell (2004) 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 infants (Baker, 1999).

The results indicated that 22.5% of children having bacteremia were 1-6 months of age. Some studies 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) (Jaskiewicz, *et. al.*, 1994). Infants aged 7 to 12 months represented a rate of 9.6% of bacteremia. This agreed with Lin, *et. al.* (1985) who reported that only (6.2%) of bacteremia was detected among infants aged 7 to 12 months. The frequency of bacteremia in children aged 19 to 24 months was 22.5%. 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 groups (McCarthy, 1998).

In conclusion, all children under 24 months of age are at higher risk for bacteremia and no significant difference was found among the age groups being investigated in this study between age and the rate of bacteremia ( $P > 0.0\%$ ).

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