Etiologic agents of Bacteremia among Newborns in Hilla City

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Abstract

A prospective study was carried out on 304 cases of bacteremia in newborn less than one year of age with fever. Cases of gastroenteritis, respiratory tract infections, and suspected sepsis in children seen or admitted to the Babylon Maternity and Children Hospital in Babylon Province - pediatric wards were studied from October /2007 to March /2008. Clinical and microbiological data were recorded in a questionnaire or obtained from patient medical records.

Most of the newborn with bacteremia (78 %) were less than 12 months old. After culturing the blood samples the results indicated that 240(78%) blood samples revealed positive cultures consisting of 166 (69.2 %) Gram-positive bacteria isolates and 74 (30.8 %) Gram-negative isolates, represented by *Streptococcus pneumoniae* consist of 36.7%, *Staphylococcus aureus* accounted for 18.1%, *Viridians streptococci* 14.5%, *Staphylococcus epidermidis* 13.3%, *Streptococcus* spp. 7.2%, *Bacillus* spp. 6% and *Clostridium* spp. 4.2% and Gram negative bacteremia causes represented by *E. coli* 40.5%, *Pseudomonas aeruginosa* 20.3%, *Salmonella typhi* 16.2%, *Acinobacter* 5.4%, *Proteus vulgaris* 2.8%, *Haemophilus influenzae* 4% and *Klebsiella pneumoniae* 10.8%, major infections of bacteremia in Newborns was in age between 1-8 months, consisting of 77%.

The rate of infection in newborns living in rural area was found to be (62.1%) while it was (37.9%) in urban newborns. The rate of infection with bacteremia in newborns feeding on breast was found to be (25.4%) while it was (74.6%) in newborn whom artificial feeding newborns.

الخلاصه

اجريت هذه الدراسه على ٣٠٤ حالة تجرثم دموي لاطفال حديثي الولاده لاتتجاوز اعمارهم السنه مصاحبين بالحمى، حالات التهاب الامعاء، اصابات الجهاز التنفسي. تم ادخال جميع الحالات الى مستشفى بابل للنسائيه والاطفال في محافظة بابل في ردهات الاطفال وامتدت الدراسه للفتره من اكتوبر ٢٠٠٧ الى مارس ٢٠٠٨. تم جمع عينات الدم من الوريد في انابيب معقمه مخصصه لهذا الغرض والخالي من مواد مانعة التخثر.المعلومات السريريه تم تسجيلها Brain Heart Infusion Broth حاويه على ٢٠ مل من وسط بواسطه استمارة خاصه من استمارة الدخول والمتابعه الخاصه بالمريض في المستشفى. معظم الاطفال الحديثي الولاده مصابين بتجرثم الدم ويشكلون نسبة ٧٨% من نسب الاصابه.

اوضحت النتائج ان ٢٤٠ طفل مصاب بتجرثم الدم ، ١٦٦ طفل (٦٩,٢%) سببها البكتريا الموجبة لصبغه كرام والمسبب لـ ٧٤ طفل (٣٠,٨%) هي البكتريا السالبه لصبغة كرام متمثله بواسطة ؛ *Streptococcus pneumoniae* ، ٣٦,٧% *Staphylococcus aureus* ، ١٨,١% *Viridians streptococci* ، ١٤,٥% *Staphylococcus epidermidis* ، ١٣,٣% *Streptococcus*

٤,٢% بالنسبه للمسببات البكتيريه الموجبه لصبغة كرام، اما المسببات *Clostridium* spp. ٦% و *Bacillus* spp. ٧,٢% ، spp. السالبه لصبغة كرام فكانت متمثله ؛ *E. coli* ٤٠,٥% ، *Pseudomonas aeruginosa* ٢٠,٣% ، *Salmonella typhi* ١٦,٢% *Klebsiella pneumoniae* ٤% و *Haemophilus influenzae* ٢,٨% ، *Proteus vulgaris* ٥,٤% ، *Acinetobacter*، ١٠,٨%.

كانت معظم الاصابات بتجرثم الدم بعمر من (١-٨) اشهر مشكلة نسبه ٧٧% ، كما ان نسب الاصابه حسب مكان الاقامه اختلفت بين الريف ٦٢,١% والمدينه ٣٧,٩%. اظهرت النتائج ايضا ان نوع التغذيه كان مؤثرا على نتيجة الاصابه حيث تكون اقل عند ذوي التغذيه الطبيعيه ٢٥,٤% من ذوي التغذيه الصناعيه ٧٤,٦%.

Introduction

Bloodstream infections are an important cause of morbidity and mortality among hospitalized patients and the surveillance of etiological agents in these infections is important for their prevention and treatment [1].

Bloodstream bacterial infections have been shown to have mortality rates of between 20% and 10% [2]. An association between the type of bloodstream organism and prognosis of the patient has been shown, with the isolation of enterococci, Gram-negative bacteria, and fungi being associated with increased mortality [3].

Bacteremia is the presence of viable bacteria in the circulating blood. Transient bacteremia may develop following dental work or other iatrogenic manipulations, but it is generally clinically benign and self-resolved in children who do not have after an outpatient evaluation [7]. Often, the only manifestation of occult bacteremia is fever or a minor infection (eg, otitis media, upper respiratory tract infection) [8].

The common causative organisms being isolated from bacteremic patients are Gram-positive organisms represented by *Staphylococcus aureus* ,*Streptococcus pneumoniae* ,*Streptococcus pyogenes* ,Coagulase Negative *Staphylococci*, *Enterococcus* an underlying illness or a turbulent cardiac blood flow [4].

Patients with occult bacteremia do not have clinical evidence other than fever of a systemic response to infection [5]. First described in the 1960s in young febrile children with unsuspected pneumococcal infection, bacteremia is defined as the presence of bacteria in the bloodstream of a febrile child who was previously healthy; the child does not clinically appear to be ill and has no apparent focus of infection [6]. A recent review defines occult bacteremia as bacteremia identified in a patient without clinical evidence of sepsis (shock or purpura) or a toxic appearance, without underlying significant chronic medical conditions, without clear foci of infection (other than acute otitis media) on examination, and who is discharged and sent home

spp. and *Listeria monocytogenes* while Gram negative organisms which are commonly isolated are *Escherichia coli*, *Klebsiella spp.*, *Proteus spp.*, *Pseudomonas aeroginosa*, *Enterobacter spp.*, *Citrobacter spp.*, *Salmonella spp.*, *Shigella spp.*, *Campylobacter* spp., *Haemophilus spp.*, *Neisseria meningitides* and *Neisseria gonorrhoeae*, in addition to anaerobic bacteria [9].

The aim of this study was to determine the most common bacterial cause of bacteremia in admitted newborn to Babylon Maternity and Children Hospital in Babylon Province - pediatric wards from October /2007 to March /2008.

Materials and Methods

Samples

308 blood samples were collected from febrile infants below One year admitted to Babylon Maternity and Children Hospital in Babylon Province, during the period from October /2007 to March /2008. Blood samples were collected in screw capped tubes containing 20 ml Brain Heart Infusion broth without anticoagulant.

Methods:

The Questionnaire

The Questionnaire with the following variables were used; Age, Type of feeding, Sex, Previous admission to hospital, Residence, Rural or Urban, Clinical features (Fever, Vomiting, Diarrhea...), Duration of fever, Antibiotic treatment. Patient must have taken no antibiotics for the last 72 hr. to avoid disturbance in results (negative false results).

Bacterial Identification

Bacterial isolates were identified to the level of species using cultural characteristics and conversional biochemical test [10, 11, and 12].

Results & Discussion:

This study shows that bacteremic samples that collected from febrile infants consist 78% of cases; consequently the results of bacteremia in children seem to be variable. This variation may be related to difference in sample size or to the population studied (patients seen in the office versus patients seen in emergency room) [13]. Ratio of Gram positive bacteremia cases are more than Gram negative bacteremia cases. In children, the microorganisms causing bacteremia are similar to those in adults, but there are several important differences.

In general, non immunosuppressed bacteremic children have an increased likelihood of being infected by Staphylococci, streptococci including *Streptococcus pneumoniae*, and meningococci; gram negative rod bacteremia is less likely except in neonates [14].

The increased frequency and changing etiology of bacteremia may be a result of varying patient population [15]. Gram positive nosocomial acquisition of bacteria by the mother and the neonate, the immune response of population groups and geographic and climatic differences and microbiologic techniques in pathogen isolation [16].

Table one showed the most common causes of gram positive bacteremia; *Streptococcus pneumoniae* was taken the higher percentage among the gram positive causes (36.7%).

Table 2 reveals causes of gram negative bacteremia; *E. coli* forms about 40.5% from all gram negative infection in this study.

In this study, 166 febrile children were bacteremic being caused by Gram-positive organisms. This result was in accordance with other studies, where

the percentages of Gram-positive and Gram- negative organisms isolated from bacteremic children were 68% and 29% respectively [17]. Chapman and Faix (2003) stated that Gram-positive organisms accounted for 84% of the positive culture results whereas Gram-negative organisms accounted for 16% in bacteremic infants [18].Another study pointed out that the etiology may even vary at different times within the same place [19].

S. epidermidis was the most frequently isolated organism in this series and perhaps the hardest one to evaluate in regard to its clinical significance. The common explanation that this organism is always a skin contaminant is most unsuitable. In 1958 reported on 5 cases of bacterial endocarditis caused by this species and cited 90 other cases, other 10 cases of endocarditis were reported attributed to *S. epidermidis* [20].

Samir *et.al*., (2003) revealed that children aged 2 to 24 months, *Streptococcus pneumoniae* was the causative organism in all 9 cases of bacteremia. With pneumonia that is treated as outpatients are at low risk of bacteremia. Widespread use of the pneumococcal conjugate vaccine may further decrease the incidence of bacteremia in this population [21].

The most commonly isolated gram-positive organism was *Streptococcus pneumoniae* [22]; gram-negative, *Escherichia coli* [23]. In other study, children who were at least 60 days of age, *S. pneumoniae* and typhoidal salmonella species were the predominant isolates, supporting results from other African [24]. Scott (2005) reported that *S. pneumoniae*, *S. aureus*, and group A streptococci predominated and that group B streptococcal infections were uncommon. We found that group B streptococcal bacteremia was the leading bacterial cause of early death in young infants [25].

Distribution of bacteremic infections according to age (in table 3) reveals that newborn between 4-12 months formed the major categories of the bacteremic infections with both gram positive and negative bacteria.

All patients being investigated in this study were below 2 years. This age group seems to be more liable for bacteremia because they have a low immunoglobulin G antibody response to encapsulated bacteria [26]. Some studies pointed that infant aged 3 to 24 Months with fever and no major source of infection were at highest risk for occult bacteremia (OB) [27]. Moreover, Kuppermann concluded that all children below 24 months were at higher risk for bacteremia [28].
The results indicated that bacteremia in newborns less than 1 month were more occur than other age groups (Gram positive 36.7%, Gram negative 36.5%), which goes with (Pantell, 2004) who found that bacteremia occurred with greatest preponderance in infants younger than 1 month[29].

Distributions of bacteremic infections (Gram positive and negative bacteria) according to sex in table (4) explain the difference between male and female bacteremic infections, in both causes (Gram positive and negative bacteria) in male infections was higher than in female.

The rate of Gram-positive Gram-negative bacteremia in male and female was (57.5%) and (42.5 %) respectively. This result is agreeable with some other studies like Shaimaa (2006) and Al-Bass (1993), which

stated that no sex based difference, exists in the prevalence of bacteremia [30 and 31].

Distributions of bacteremic infections (Gram positive and negative bacteria) according to residence in table (5) explain the difference between rural and urban bacteremic infections, in both causes (Gram positive and negative bacteria) in rural infections were higher than in Urban.

Difference between rural and urban patients related to the bad socioeconomic status, malnutrition and lack of medical facilities [32].

In addition to possible factors like poor hygiene in the delivery room and in neonatal care units, no colostrums feeding and umbilical or skin infections during the early neonatal period [33 and 34].

Table (6) reveals the common clinical features in bacteremic patients. The rest clinical features are usually associated with bacteremia (fever, cough, rash, vomiting and Diarrhea). Some features may help to identify the causative organisms. Infections above the diaphragm are more likely to be due to Gram-positive organisms. Infections in the abdomen, including the biliary and urinary tracts are more likely to be due to Gram-negative bacteria. However, no secure methods are available other than those based on laboratory diagnosis for differentiating Gram-positive from Gram-negative causes of bacteremia [35].

Distributions of bacteremic infections (Gram positive and negative bacteria) according to type of feeding in table (7) explain the difference between breast feeding and artificial feeding bacteremic infections, in both causes (Gram positive and negative bacteria) in rural infections were higher than in Urban.

These results are agreeable with Shams Al-Deen (2001) and Shaimaa (2006) who found that children with artificial feeding have higher risk of bacteremia than those on breast-fed [36],[. This indicates that natural breast feeding decreases the incidence and/or severity of a wide range of infectious diseases including bacterial meningitis, bacteremia, diarrhea, respiratory tract infection, necrotizing enterocolitis, otitis media, urinary tract infection, and late-onset sepsis in preterm infants. In addition, postneonatal infant mortality rates in United States were reduced by 21% in breast-fed infants [37].

Results

Table (1)Types and percentages of (Gram +) bacterial isolates recovered from blood samples of bacteremic children

Gram (+) bacteremia	No.	%
Streptococcus pneumoniae	61	36.7
Staphylococcus aureus	30	18.1
Viridians streptococci	24	14.5
Staphylococcus epidermidis	22	13.3
Streptococcus spp.	12	7.2
Bacillus spp.	10	6
Clostridium spp.	7	4.2
Total	166	100

Table (2)Types and percentages of (Gram -) bacterial isolates recovered from blood samples of bacteremic children

Gram (-) bacteremia	No.	%
E. coli	30	40.5
Pseudomonas aeruginosa	15	20.3
Salmonella typhi	12	16.2
Acinetobacter	4	5.4
Protues vulgaris	2	2.8
Haemophilus influenzae	3	4
Klebsiella pneumoniae	8	10.8
Total	74	100

Table (3) Distribution of bacteremic infections according to age (months)

Age (months)	G+	%	G-	%
< 1	61	36.7	27	36.5
1-4	63	38	19	25.7
5-8	29	17.5	11	14.8
9-12	13	7.8	17	23
Total	166	100	74	100

Table (4)Distribution of bacteremic infections (Gram positive and negative bacteria) according to sex.

Bacteremia \ Sex	Male	%	Female	%	Total
G+	98	40.8	68	28.3	166
G-	40	16.6	34	14.2	74
Total	138	57.5	102	42.5	240 100%

Table (5)Distribution of bacteremic infections (Gram positive and negative bacteria) according to residence.

Bacteremia \ Residence	Rural	%	Urban	%	Total
G+	103	43	63	26.2	166
G-	46	19.1	28	11.7	74
Total	149	62.1	91	37.9	240 100%

Table (6)Clinical features in bacteremic infection

Clinical features	No. (240)	%
Fever	215 (>38ºC)	89.6
Rash	13	5.4
Abdominal pain	42	17.5
Vomiting	40	16.7
Diarrhea	57	23.6
Jaundice	8	3.3
Cough	28	11.7
White cell counts 10^9/L	202 (>13)	84.2
Neutrophils	188 (>75)	78.3

Table (7)Distribution of bacteremic infections (Gram positive and negative bacteria) according to type of feeding.

Bacteremia \ Residence	Breast	%	Artificial	%	Total	
G+	44	18.3	122	50.8	166	
G-	17	7.1	57	23.8	74	
Total	61	25.4	176	74.6	240	100%

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