Bacterial Profile and Antimicrobial Susceptibility in Neonatal sepses, Al - Alwyia Pediatric Teaching Hospital in Baghdad

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ABSTRACT

Background: Neonatal septicemia is a major health problem in developing countries furthermore data on bacteriological profile in early onst sepses (EOS) and late neonatal sepsis (LOS) are lacking in context of continuous change in bacteriological profile and increasing resistant strains.

Objectives: The study done to determine the pattern of organisms implicated in neonatal septicemia in a neonatal care unit and to measure the degree of bacterial resistance to some antibiotics.

Type of the study : cross -sectional study.

Methods: Confirmed cases of neonatal septicemia admitted at Al-Alwyia pediatric teaching hospital for the period from January 2011- January 2012 were included which constitute 107 case. Blood samples were obtained, incubated and Subculture was done on blood agar and MacConkey Agar routinely after 48 hours and 7 days and in between if visible turbidity appeared. Bacterial isolates and antibiotic sensitivity were identified by standard conventional methods.

Results EOS constituted 29.9%(32 case) of confirmed neonatal sepsis , while LOS constituted 70.1% (75case) .Eescehrichia coli (E. coli) constitutes 37% of EOS followed by *Klebsella pneumonia* and Staphylocoocus species (which constitute 12.5% for each of them) were the most common microorganisms, while for LOS: E.coli constituted 38.7 % of LOS followed by Staphylocoocus species 17.3% and *Klebsella pneumonia* 10.7%. Gram negative (G negative) bacteria predominated over gram positive (G positive) bacteria in both EOS (81.2%) and LOS (74.7%) . Staphylocoocus species predominates G positive sepsis in both EOS and LOS. Group B streptococci are not identified in the study sample. Microorganisms tested shows highly resistant to amoxicillin or ampicillin and to gentamycin.For amoxicillin or ampicillin higher resistant (100%) were encourted with *pseudomonas*, proteus and *Enterobacter*. For cefotaxime high rate of resistance encountered with *klebsella* (71.4%) compared to 40% resistant in pseudomonas. Amikacin also shows varied degree of resistant for E. coli(22%) and klebsella (41%) , pseudomonas(10%) ,and *Enterobacter* (16.7%) .for *Staphylococcus aureus, proteus* and *citrobacter* no resistance was encountered to amikacin and the sensitivity was 100% in tested isolates .

Conclusions: G negative bacteria is more common in EOS and LOS with predominant of *E. coli* in two categories .Resistant strains to commonly used antibiotics is a common finding. Guidelines in treatment of neonatal sepsis should be frequently reviewed taking in consideration antimicrobial resistance . Due to magnitude of problem, preventive measures for EOS and LOS should be considered.

Key words: Early onset sepsis (EOS), Late onset sepsis (LOS), Neonatal Sepsis, antimicrobial resestance

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The incidence of neonatal sepsis is 1-4 per 1000 live births in developed countries[1] while in developing countries, the incidence of neonatal sepsis is about 3.5-4.3 cases per 1000 live births[2]. Neonatal sepsis may be categorized as early onset sepsis (EOS) presenting in first 72 hours of life or late-onset (LOS) presenting after 72 hours of life . EOS is associated with acquisition of microorganisms from the maternal birth canal. Transplacental infection or an ascending infection from the cervix may be caused by organisms that colonize the mother's genitourinary tract; the neonate acquires the microorganisms as it passes through the colonized birth canal at delivery as in EOS or is acquired from the care giving environment as in LOS [3,4]. A very wide spectrum of organisms has been described for cases of neonatal septicemia and this spectrum is subjected to geographical alterations . Moreover, the isolated organisms are often resistant to multiple antimicrobials which make the treatment difficult and grave sequele ensue [5]. The choice of antibiotics treatment for neonatal sepsis must be driven by hospital -specific guidelines based on prevalent organisms and their susceptibility patterns in the particular nursery/hospital environments [6] Historical reviews have also demonstrated that the predominant organisms responsible for neonatal sepsis have changed with time[7]. In context of changing microorganism profile worldwide and scarce of data (locally) regarding causative microorganisms in neonatal unit (NNU) and the microorganisms' sensitivity to antibiotics this study

is done to reveal current profile in neonatal word in Al-alwyia pediatric teaching hospital in Baghdad and to reveal bacteriological susceptibility for antibiotics.

Methods: All confirmed cases of neonatal septicemia diagnosed and treated in the neonatal unit at al-Alwyia pediatric teaching hospital for the period from January 2011- January 2012 were included in this study which constitute 107 cases. A case of sepsis was defined as an infant who had clinical signs of infection or those who were born to mothers with risk factors for infection, in whom blood culture grew a bacterial pathogen.EOS include all cases presented during 72 hours of life while LOS after 72 hours of life till 28 days of life .Neonatal period constitute the first 28 days of life Blood cultures were collected before starting antibiotics from all neonates with risk factors of sepsis and whenever relevant clinical signs were present. Blood samples were obtained under strict aseptic conditions .The skin site was cleansed with 70% alcohol and povidone iodine (1%) followed by 70% alcohol again. One- to two-mililiter blood samples were withdrawn and injected in aerobic broth bottles then incubated at 37°C for 7 days and observed daily for any turbidity due to bacterial growth. Subculture was done on blood agar and MacConkey Agar routinely after 48 hours and 7 days. Subculture was also done in between if visible turbidity appeared. Bacterial isolates were identified by conventional biochemical and serological methods. Antimicrobial susceptibility test was performed using the standard disc diffusion (Kirbey-Bauer) method.

Results: A total number of 107 blood culture confirmed cases were studied. As shown in table 1 ,EOS constitute 29.9% of overall septicemia (32cases) ,while LOS constitute 70.1% (75 cases).In order of frequency the study shows that microorganisms causing EOS are :E.*coli* accounts 12 (37% of EOS) followed by Kleb*sella pneumonia* and *Staph species (pp.*) 4(12.5%) ,*Pseudomonas pp.* and *Acinetobacter pp.* 3(9.4%) for each , Proteius and *Citrobacter pp.* 2(6.2%)for each , *Enterococcus pp.* and *candida*1 (3.1%)for each.In order of frequency the study shows that microorganisms causing LOS are :*E.coli* accounts 29(38.7 of LOS), *Staphylococcus pp.* 13(17.3%) ,*Klebsella pneumonia* 8(10.7), *Pseudomonas pp.* and *Enterobacter cloacae* 7(9.3%) for each , *Acinetobacter pp.* 4(5.3%) ,*Strep pneumonia, Citrobacter pp.* and *candida*1(1.3%)for each of them .*Overall isolated cases the 3 most common microorganisms are Ecoli 41 (38.3%), Staphylococcus pp.* 17(15.9%) and klebsella pneumoni 12(11.2%).No isolates were found for group B *streptococcus* , *Haemophilus influenza* and *listeria* in both EOS and LOS. G negative Bacteria predominates in both EOS(24.3% for G negative vs 4.7% for G positive bacteria) and LOS(52.3%for G negative vs 16.8% for G positive) . *E.coli* is the most common G negative bacteria encountered in EOS and LOS . Staph species. is the most common G positive bacteria encountered in EOS and LOS .

Table 1 : Bacteriological profile of EOS and LOS

Type of bacteria	No. of EOS (%within total) (% within EOS)	No.of LOS (%within total) (% within LOS)	Total no.(%)
A-G Negative Bacteria			
E.coli	12 (11.2) (37.5)	29(27.1)(38.7)	41 (38.3)
Klebsella pneumonia	4 (3.7)((12.5)	8(7.5)(10.7)	12(11.2)
Pseudomonas species			
Pseudomonas Fluorescent	1 (0.9)	0	1(0.9)
Pseudomonas putida	0	1(0.9) (1.3)	1(0.9)
Pseudomonas stutzeri	1(0.9) (6.2)	0	1(0.9)
Pseudomonas aerogenosa	1(0.9) (6.2)	6 (5.6)(8)	7(6.5)
Pseudomonas Total	3(2.8)(9.4	7(6.5)(9.3)	10(0.9)
Proteius	2(1.9) (6.2)	0	2(1.9)
Enterobacter cloacae	0	7(6.5)(9.3)	7(6.5)
Citrobacter species			
Citrobacter cloaca	2(1.9)(6.2)	0	2(1.9)
Citrobacter fruendi	0	1(0.9) (1.3)	1(0.9)
Citrobacter Total	2(1.9)(6.2)	1(0.9) (1.3)	3(2.8)
Acinetobacter pp.			
Acinetobacter cloaca	2(1.9)(6.2)	0	2(1.9)
Acinetobacter bumannii	1(0.9) (3.1)	4(3.7)(5.3)	5(4.7)
Acinetobacter Total	3(2.8)(9.4)	4(3.7)(5.3)	7(6.5)
B- G positive Bacteria			
Strep pneumonia	0	1(0.9)(1.3)	1(0.9)
Staphylococcus species			
Staphylococcus aureus	0	5(4.7)(6.8)	5(4.7)
Staphylococcus hemolyticus	1(0.9)(3.1)	2(2.6)	3(2.8)
Staphylococcus epidermedis	3(2.8)(9.4)	5(4.7)(6.7)	8(7.5)
Staphylococcus scisuri	0	1(0.9) (1.3)	1(0.9)

Staphylococcus . Total	4(3.7)(12.5)	13(12.1)(17.3)	17(15.9)
Enterococcus species			
Enterococcus faecalis	1(0.9)(3.1)	3(2.8)(4)	4(3.7)
Enterococcusfacuim	0	1(0.9) (1.3)	1(0.9)
Enterococcus Total	1(0.9)(3.1)	4(3.7)(5.3)	5(4.7)
C- Organism type isolated			
Candida	1(0.9)(3.1)	1(0.9) (1.3)	2(1.9)
G Negative Bacteria	26(24.3)(81.25)	56(52.3)(74.7)	82(76.6)
G positive Bacteria	5(4.7)(15.6)	18(16.8)(24)	23(21.5)
Total	32(29.9)(100)	75(70.1)(100)	107(100)

1- Sensitivity test for *E. coli*	*Ampicillin* No(%)	Cfotaxime No(%)	Gentamycin No(%)	Amikacin No(%)		
R	33(80.5)	21(51.1)	9(22)	9(22)		
S	8(19.5)	20(50.9)	32(78)	32(78)		
Total tested	41(100)	41(100)	41(100)	41(100)		
2-Sensitivity test for for *Klebsella pneumonia*	Cefotaxime No(%)	Ceftriaxone No(%)	Ampicillin No(%)	Gentamycin No(%)	Amikacin No(%)	Ceftazidim No(%)
R	5(71.4)	6(85.7)	9(90)	7(63.6)	5(41.7)	5(71.4)
S	2(28.6)	1(14.3)	1(10)	4(36.4)	7(58.3)	2(28.6)
Total tested	7(100)	7(100)	10(100)	11(100)	12(100)	7(100)
3-Sensitivity test for *Pseudomonas*	amoxicillin	Gentamicin	amikacin	Cefotaxime		
R	3(100)	4(44.4)	1(10)	4(40)		
S	0	5(55.6)	9(90)	6(60)		
Total tested	3(100)	9(100)	10(100)	10(100)		
5- Sensitivity test for *Staphylococcus aureus*	Ampicillin No(%)	Cefotaxime No(%)	Amikacin No(%)	Gentamicin No(%)		
R	4(80)	4(80)	0	3(60)		
S	1(20)	1(20)	5(100)	2(40)		
Total tested	5(100)	5(100)	5(100)	5(100)		
5-Drugs sensitivity test for proteus	Amoxicillin No(%)	Ggentamycin No(%)	Amikacin No(%)	Ceftazidim No(%)		
R	2(100)	2(100)	0	1(100)		
S	0	0	2(100)	0		
Total tested	2(100)	2(100)	2(100)	1(100)		
6- Drugs sensitivity test for Enterobacter	Ampicillin No(%)	Cefotaxime No(%)	Ggentamycin No(%)	Amikacin No(%)		
R	7(100)	4(57.1)	4(66.7)	1(16.7)		
S	0	3(42.9)	2(33.3)	5(83.3)		
Total tested	7(100)	7(100)	6(100)	6(100)		
7- Sensitivity test for Citrobacter	Ampicillin No(%)	Ceftriaxone No(%)	Ggentamycin No(%)	Amikacin No(%)		
R	2(66.7)	1(33.3)	0	0		
S	1(33.3)	2(66.7)	1(100)	3(100)		
Total tested	3(100)	3(100)	1(100)	3(100)		
8-Sensetivity test fo Enterococcus	Ampicillin	Ciprofloxacin	Ggentamycin	Imipenem		
R	4(80)	1(20)	3(75)	1(20)		
S	1(20)	4(80)	1(25)	4(80)		
Total tested	5(100)	5(100)	4(100)	5(100)		
9- Sensitivity test for Acinatobacter	Ampicillin	Ceftazidime	Cefotaxime	Gentamycin		
R	5(83.3)	2(28.6)	1(14.3)	1(14.3)		
S	1(16.6)	5(71.4)	6(85.7)	6(85.7)		
Total tested	6(100)	7(100)	7(100)	7(100)		

Table 2 Bacterial sensitivity tests

Sensitivity test for *E. coli* tests shows that the microorganism is resistant to *Ampicillin in (*33)80.5% , Cefotaxime 21(51.1%) Gentamycin and Amikacin in 9(22%).Drugs sensitivity test for *Klebsella pneumonia* shows that the microorganism is resistant to Cefotaxime in 5(71.4%) , Ceftriaxone 6(85.7%), Ampicillin 9(90%), Gentamycin 7(63.6%), Amikacin 5(41.7%),and to Ceftazidim in 5(71.4%).

Drugs sensitivity test for Pseudomonas revealed that it is resistant to amoxicillin in 3(100%), to Gentamicin in 4(44.4%), to amikacin in 1(10%), and to Cefotaxime in 4(40%).Drugs sensitivity test for Staphylococcus aureus revealed that it is resistant to Ampicillin and Cefotaxime in 4(80%) respectively , to Gentamicin in 3(60%), and no resistant to Amikacin in 5 (100%) of tested isolates .

Drugs sensitivity test for proteus *revealed that it is* resistant to amoxicillin and Gentamycine in 2(100%), respectively, to Ceftazidim in 1(100%) and no resistant to Amikacin in 2 (100%) of tested isolates .

Drugs sensitivity test for Enterobacter revealed that it is resistant *to* Ampicillin in 7(100%),to Cefotaxime in 4(57.1%) to Ggentamycin in 4(66.7%) and to Amikacin in 1(16.7%) of tested isolates .Drugs susceptibility test for citrobacter revealed that it is resistant *to* Ampicillin in 2(66.7%), to Ceftriaxone in 1(33.3%) ,no resestance to Ggentamycin in 1(100%) tested isolate and no resestance to Amikacine in 3(100%) tested isolates .

Drugs susceptibility test fo Enterococcus revealed that it is *resistant to* Ampicillin in 4(80%), to Ciprofloxacin in 1(20%) to Ggentamycin in 3(75%),and to Imipenem in 1(20%).Drug sensitivity for Acinatobacter *revealed that it is resistant to* Ampicillin in 5(83.3%),to Ceftazidime in 2(28.6%),to Cefotaxime in 1(14.3%) and to Gentamycin 1(14.3%).

Discussion : In Arab countries EOS widely ranged from 24 to 74%[8] . Our finding(29.9%) lies within this range indicating that LOS is more predominant that EOS. This agrees with study at Al-Kadimiya teaching hospital in 2010 were 24 cases (32.9%) had EOS and 49 cases (67.1%) cases had LOS.[9] .

Twelve studies from eight Arabic countries including 2308 newborns with culture proven EOS, G negative organisms were the predominant pathogens in Libya, Egypt, Jordan, and Iraq (65-90% of all EOS cases[8} ,this agrees with our study where G negative bacteria is constituting 81.25% while Klebsiella species , Serratia species, Enterobacter species, Escherichia coli, and Pseudomonas species being the most frequent bacteria in Libya, Egypt, Jordan, and previous studies in Iraq[8,10] . E.coli and Klebsella pneumonia are predominant microorganisms in our study . In Baghdad teaching hospital/ medical city[11] it was found(simmilar to our study) that E. coli was the most common bacteria isolated in 19(23.7%), followed by Klebsiella pneumoniae16(20%). In study from Iran K. pneumoniae was the predominant causative bacteria of EOS followed by E. cloacae and E. coli.

In Saudi Arabia, Bahrain and Kuwait, the G-positive microorganisms, coagulase negative Staphylocooci and Staphylococcus aureus were taking the lead (64-75%)[8], while in our study Staphylocooci constitute 12.5% of EOS. While in study at al-kadimiya teaching hospital in 2010 staphylococci constitute 46% of EOS cases these indicates that staphylococci is playing a role in EOS in Iraq in addition to G negative bacteria . Group B Streptococci were the predominant pathogen (24%) in the United Arab of Emirates (UAE). Candida pp. were emerging in Egypt, UAE, Bahrain, and Kuwait [8]. Low incidence of group B streptococci in this study is similar to the results reported at other hospitals in Iraq and studies in developing countries [12,9,13] In Al Anbar just one case was detected [14] .While in USA still GBS is the most predominant[15]. In medical city Baghdad teaching hospital group B streptococci were 9(11.2%) [11] , which contradicts other studies in Iraq including our study.

In USA the microorganisms most commonly associated with EOS include the following: Group B *Streptococcus (GBS),*Escherichia,coli,Coagulase-negative Staphylococcus ,Haemophilus influenzae *,and* Listeria monocytogenes. *Trends in the epidemiology of EOS show a* decreasing incidence of GBS disease. [15] In Al Anbar Staphylocooci And Klebsiella constitute main microorganisms for LOS[14] . Similar to our study Staphylococci predominate G positive and E.coli predominate G negative sepsis at Al-Kadimiya teaching hospital in 2010.[9] The study also reveals that 59% of LOS are due to G negative and 41% G positive bacteria . In our study G negative bacteria constitute 74.7 % of LOS where E.coli 29(38.7%), Staphylocooci 13(17.3%) ,Klebsella pneumonia 8(10.7) constitute the most common 3 microorganisms .E.coli is the predominant microorganisim in our study in both EOS and LOS. According to WHO the most frequent bacteria causing G negative sepsis in developing countries is E Coli[16].

In developed countries staphylococcus aureus was previously responsible for the majority of late onset infections in many neonatal units with other commonly isolated organisms being coagulase negative staphylococci, E coli, group B streptococcus, Klebsiella pneumoniae, enterococcus, candida and pseudomonas. Coagulase negative staphylococci have now emerged as the leading cause of LOS in almost all developed countries and account for > 50% of positive blood cultures [17, 18,19]. An increase in sepsis caused by G-negative organisms has been reported in recent years. [20]. All microorganisms tested shows low sensitivity (highly resistant) to amoxicillin or ampicillin and to gentamycin, this goes with agreement with previous study in this hospital in 2001 on E.coli [21].

For amoxicillin or ampicillin higher resistant (100%) were encourted with pseudomonas ,proteus and Enterobacter . For cefotaxime the higher rate of resistance (within G negative bacteria) encountered with klebsella) (71.4%) compared to 40% resistant in pseudomonas for the same antibiotic Amikacin also shows varied degree of resistant by E. coli(22%) and klebsella(41%) , pseudomonas(10%) ,and Enterobacter

(16.7%) while for *Staphylococcus aureus,* proteus and citrobacter the sensitivity was 100% in tested isolates .

Various degrees of antibiotic multi -resistant strains in neonatal sepsis is found in another neonatal unit in Baghdad[9] .

This is in line with data from other studies suggesting high rates of antibiotics resistance among isolates implicated in neonatal sepsis[22,23,24].

This high resistant rate might be due to abuse of AB, lack of local policy guidelines and to emerging resistant strains all over the world [25].

Conclusions and recommendations :

G negative bacteria is more common in EOS and LOS with predominant of E. coli in two categories .

Resistant strains to available and commonly used antibiotics is a common finding.

Guidelines in treatment of neonatal sepsis should be frequently reviewed and updated.

Preventive measures for EOS and LOS should be primarily considered.

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