



Most Common Organism Causing Meningitis In Blood Culture Positive Neonates And Profile Of Proven Sepsis And Meningitis In A Tertiary Care Hospital-A Retrospective Cohort Study

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract: Even though meningeal penetration mainly depends upon number of bacterial colonies the relative proportions for each organism differ somewhat ,because of their virulence factors. In this study we retrospectively studied which organisms causing meningitis in blood culture positive sepsis(proven sepsis)

Aim: Consideration of virulence factors necessary for treating sepsis

Methodology: A retrospective cohort study in Neonatology department at Niloufer Hospital Hyderabad from April 2017 to September 2018 Results:Most common organism penetrating brain in our study were Enterococcus, Staphylococcus aureus and Klebsiella .

Introduction: Neonatal meningitis is one of the causes for greatest morbidity and mortality in neonates (1). Neonatal meningitis is defined as inflammation of meninges during first 28 days of life (2) In various studies the incidence of meningitis showed as 0.3-3%(3-5). Even though meningeal penetration mainly depends upon number of

bacterial colonies the relative proportions for each organism differ somewhat because of the varying propensity to invade the CNS and some bacteria will have specific virulence factors for example, group B Streptococcus type III and K1 strains of E. coli have distinctive capsules, which contain polysaccharide with sialic acid in high concentration (25% of total carbohydrate). Some bacteria have separate mechanisms for brain penetration like GBS E.coli and Listeria enter the CNS by residing inside neutrophil .Streptococci CbpA will promote endocytosis and meningococci's PilC1 adhesion molecule interacts with CD46 (6-9).Some bacteria will cause extensive damage of brain like Citrobacter, Serratia, Enterobacter will cause extensive necrosis and hemorrhage in brain. S. pneumoniae, releases , H₂O₂ and pneumolysin, a pore-forming cytolysin causes extensive CNS damage(10-12). Virulence of bacteria also determine the duration of treatment for example in case of S.aureus 10 days of treatment also causes treatment failure

unlike coagulase negative staphylococcus where 3 days also enough. Gram negative meningitis and listeria needs more days of antibiotics than others(13 ,14) .There is a strong association of meningitis and sepsis with positive blood cultures [15].

In our present study our main objective is to find out most common organism causing meningitis in blood culture positive cases of sepsis. As it helpful in alertness in terms of meningitis when organism isolated in blood culture and selection meningeal penetrating antibiotics away from regular protocol. Even though in every blood culture positive baby CSF analysis and CSF culture will be doing in many cases of meningitis .CSF analysis and culture will be negative due to various reasons like early administration of antibiotics before blood culture become positive and less sensitive particularly CSF culture and CSF changes will take time (16,17,18) .

Aim: To know the most common organism causing meningitis in blood culture positive neonates is our primary objective and we also studied clinical profile of blood culture positive neonates and meningitis

Methodology: It is retrospective cohort study from April 2017 to September 2018 conducted in neonatology department niloufer hospital Hyderabad. Blood culture positive neonates in previous six months were included in this study. Intramural (as we are different protocols for intramural and extramural babies and incidence was low in intramural babies) and neonates more than 28 days and culture positive babies for commensals were excluded from the study. Data collected from retrospectively from records and case sheets easily as we are following strict protocols and case sheet proforma .We excluded contaminants from culture positivity and if different organisms present in same baby we considered as another culture, we correlated time of sending blood culture and CSF culture.

Sample size was calculated at alpha error 0.05 and power

80 as 160 by using Open epi online software. CSF analysis done as per standard values (19)

Results: Our profile of Proven sepsis (culture positive sepsis) and meningitis are shown on Table 1 and 2

Table :1 Profile of Bacteremia	
No of Admissions	6000
Total cases	166
female: male	65:101
EOS:LOS	58:108
preterm: term	74:92
BW<2.5Kg:>2.5Kg	64:102
Klebsiella pneumoniae	53(31.92%)
Staphylococcus aureus	26(15.6%)
Enterococcus	19(11.4%)
Coagulase negative Staphylococcus	8(4.8%)
Streptococcus pneumoniae	7(4.2%)
Candida	10(6.02%)
Pseudomonas	12(7.22%)
Staphylococcus epidemidis	7(4.2%)
Acinetobacter baumannii	14(8.4%)
others	10(6.02%)
Expired	12
Klebsiella pneumoniae	4(33.3%)
Enterococcus	5(25%)
Acinetobacter baumannii	2(16.6%)
Pseudomonas	2(16.6%)
candida	4(33.3%)
Mortality	12
female: male	4:08
preterm: term	5:07
BW<2.5Kg:>2.5Kg	6:06
Organisums	12
Enterococcus	2(25.16%)
Klebsiellapneumoniae	5(41.%)
Staphylococcus aureus	2(25.16%)
Candida	1(8.3%)
Pseudomonas	1(8.3%)
Acinetobacter baumannii	1(8.3%)
Type of sepsis	
Respiratory	32(19.20%)
Lethargy/Poor feeding	68(40.9%)
UTI	14(8.4%)
NNJ	18(10.8%)
Fever	10(6.04%)
Abdominal distention	7(4.2%)
Others	17(10.2%)

Total number of culture positive sepsis were 166 .Most common organisms causing bacteremia were Klebsiella ,Staphylococcus aures and enterococcus 31.92,15.6 and 11,4% respectively. Most of the cases clinically present like general signs (40.9%) and respiratory signs and symptoms. Twelve babies expired out of 166 Klebsiella causing 41% deaths and enterococcus ,staphylococcus aures causing each as 25.16%. Number of meningitis cases were 33 out of 166 but culture positive meningitis were 4 (2.4%). Most commonly caused by Klebsiella(30.3%),Staphylococcus(24.24%) and enterococcus(21.25%).Most common organism causing mortality in meningitis was Enterococcus. Meningitis cases with pneumonia were commonly associated with mortality.

Table:2 Clinical Profile and Outcome of meningitis

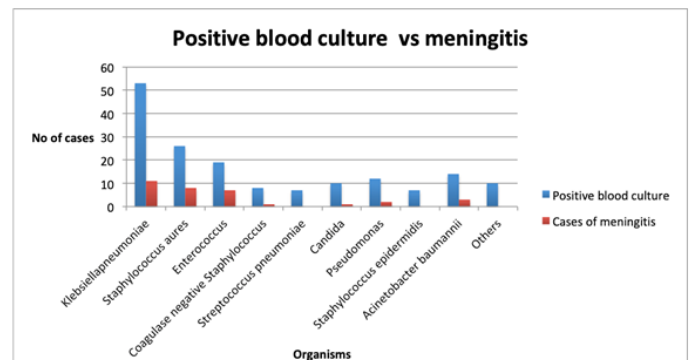
No of blood culture positive cases	166
No of meningitis cases	33
No of Positive CSF culture cases	4
EOS:LOS	14:19
preterm:term	12:21
BW<2.5Kg:>2.5Kg	14:19
Preterm EOS	6
Preterm LOS	6
Term EOS	8
Term LOS	13
Type of Organism	
Klebsiellapneumoniae	11(33.3%)
Enterococcus	7(21.2%)
Staphylococcus aures	8(24.24%)
Candida	1(3.03%)
Coagulase negative Staphylococcus	1(3.03%)
Pseudomonas	2(6.06%)
Acinetobacter baumannii	3(9.09%)
Type of Sepsis	
Respiratory	11(33.33%)

Meningial signs	10(30.03%)
UTI	1(3.03%)
General signs	13(39.39%)
Skin &IV Canula	2(6.06%)
Mortality	
No of cases	4
preterm:term	1:02
male:female	3:01
EOS:LOS	1:03
Type of Organism	
Enterococcus	2(50%)
Klebsiellapneumoniae	1(25%)
Candida	1(25%)
Type of Sepsis	
Respiratory(Pneumonia)	3(60%)
Meningial signs	1(20%)
General signs	1(20%)

Table 3:

Organism	Positive bloodculture	Meningitis proven by CSF analysis(Positive culture)	Percentage (%)
Klebsiellapneumoniae	53	11 (2)	18.86%
Staphylococcus aures	26	8 (1)	30.76%
Enterococcus	19	7 (1)	36.84%
Coagulase negative Staphylococcus	8	1	12.5%
Streptococcus pneumoniae	7		
Candida	10	1 (1)	10%
Pseudomonas	12	2	16.66%
Staphylococcus epidemidis	7		
Acinetobacter baumannii	14	3	21.4%
Others	10		

Figure 1:



Above Table and Bar diagram shows most common organisms penetrating to brain in descending order Eterococcus, staphylococcus aureus ,Acinetobacter and

Klebsiella with percentages like 36.84%,30.76%,21.4%and18.86%.

Discussion

As we know neonatal meningitis is associated with severe morbidity and mortality .It is important to diagnose and treat properly as it is treatable and if we missed or not treated properly at neonatal period it may land the baby in lifelong disability. Usually CSF culture was the gold standard for diagnosing meningitis it was less sensitive as in many cases we will start antibiotics before blood culture positivity. That's why biochemical abnormalities in CSF or any clinical signs of meningitis and blood culture positivity usually consider as meningitis. CSF changes also will take time. In our study both EOS and LOS caused by equally by gram positive and gram negative organisms unlike other studies(20) Fever , poor feeding ,lethargy and meningeal signs , were the common signs and symptoms in meningitis comparable to other studies(21,22) Gram-negative bacteria dominate in community-acquired sepsis, in developing countries(23,24) . In our study meningitis common in late onset sepsis like other studies (25)

According to Thaver D et al .I n developing countries culture-proven sepsis in 16 per 1000 live births and neonatal meningitis in 0.8–6.1 per 1000 live birth in our study less because all were out born babies and most of the cases started antibiotics out side hospitals from periphery (26) .In our study CSF culture positivity is rare as similar to NNPD 2000 data due to various reasons mentioned above (27,28) ,incidence of culture-positive meningitis, as well as the distribution of organisms in this cohort, was similar to previously reported cohorts of hospitalized infants(27-29). Here our primary objective of this study is most common organism causing meningitis in culture positive sepsis. Though most common pathogens causing meningitis were *Klebsiella* sp, *S. aureus* and enterococcus in our study comparable to other

studies(23,24) ,in our study we find out that Eterococcus,staphylococcus aureus ,Acinetobacter and Klebsiella will enter the CSF more commonly than other organisms .

Conclusion: Most common organism penetrating brain in our study were Enterococcus, Staphylococcus aures and Kliebsiella .It is better to consider the virulence factors of bacteria as some are more chances of invading meninges than others. Usually we will start antibiotics before blood culture positivity most cases CSF may be normal that's why if we isolate organism from blood which will invade meninges more careful observation and follow up needed even though CSF is normal as it take s time to appear changes. In terms of Duration of antibiotics also better to consider virulence factors of organisms.

Limitations: Many risk factors not considered which will disrupt Blood brain barrier.

Recommendations: A detailed research needed on changing pattern and mutations of virulence factors of brain penetrating organisms.

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