ORIGINAL ARTICLE

A CLINICOMICROBIAL ASSOCIATION IN NEONATAL SEPTICEMIA

Neeraj Kumar Jain, Deepak Seth, Vibha Mangal

Abstract

This prospective study was done in 167 neonates to analyze the clinical profile, etiological agents and radiological features for septicemia in neonates admitted at our center from June 2008 to January 2010. Common clinical manifestations were refusal to feeds in 102 (61%), respiratory distress in 89 (53%), lethargy in 66 (40%), convulsions in 49 (29%), abdominal distension in 38 (23%), hypothermia in 33 (20%), jaundice in 24 (14%) and hyperthermia in 8 (5%). Many patients in the study had more than 2 clinical features at the time of presentation. Blood culture was positive in 52 (27%) of babies of which 37 (34%) of preterm babies, and 15 (19%) of term babies which was statistically significant (p=0.004). Organisms grown on blood culture are E.coli in 12 (23%), klebsiella pneumonia in 19 (37%), acinetobacter species in 2 (4%), staphylococcus aureus in 3 (6%), citrobacter freundii in 1 (2%), pseudomonas in 8 (15%), coagulase negative staphylococcus in 5 (10%) and yeast in 2 (4%). Common organisms causing pneumonia are klebsiella and staphylococcus aureus. Organisms associated with neonatal enterocolitis (NEC) are E.coli and klebsiella. Septic arthritis is associated with bacteremia and organism associated is staphylococcus aureus.

Conclusion: Commonest infection associated with neonatal sepsis is pneumonia and neonatal sepsis is more common in preterms. Organisms involved seem to vary with organs affected.

Introduction

Neonatal sepsis is a clinical syndrome characterized by systemic signs of infection and accompanied by bacteremia in the 1st month of life. According to National Neonatal Perinatal Data (NNPD 2002-03) incidence of neonatal sepsis in 30/1000 live birth (1)

The microbial etiology of neonatal sepsis is variable and often changes temporarily. Group B streptococci is a common cause of neonatal sepsis in west but infrequent in India and other tropical countries. Staphylococcal aureus, klebsiella, E.coli along with coagulase negative staphylococcus and pseudomonas are the main organisms responsible for neonatal septicemia in India (2). In view of the fulminating course of neonatal septicemia every attempt should be made for early diagnosis and management (3). Various diagnostic tests (hematological, biochemical and radiological) can be performed easily and results may be available in an hour or so. However, blood culture remains the gold standard for the diagnosis of neonatal septicemia (4). Radiological imaging plays a prominent role in the evaluation and treatment of patients with septicemia. Chest radiography is the most commonly used imaging tool in pneumonias because of easy availability and an excellent cost-benefit ratio. A specific radiological pattern can suggest a diagnosis in most of the cases (5). The abdominal radiograph is sufficient for an accurate diagnosis of NEC, and the presence of air on a horizontal- beam radiograph is sufficient to diagnose a bowel perforation. CT however not recommended for the diagnosis of NEC but may demonstrate pneumatosis or a site of perforation. Ultrasonography of the abdomen characteristically shows thick walled loops of bowel (6). In cases of suspected meningitis ultrasound cranium shows ventricular dilation, increased echogenicity and formation of septations. It has been shown to be the initial investigation of choice for imaging and correlates with the CT finding well (7).

The outcome of a neonate with septicemia largely depends on early identification. To meet this end the present study was carried out to study the clinical profile, etiological agents and radiological features for septicemia in neonates admitted at our center.

Material and Methods

The proposed study was carried out on cases suspected of having septicemia over a span of about one year from June 2008 to January 2010. The cases were drawn from neonates born in Himalayan Institute of Medical Sciences and neonates referred from outside. Informed consent from respective guardians was obtained. All the neonates presenting with symptoms and signs suggestive of septicemia or those with risk factors for the same were taken up for the study. A detailed history was taken and recorded on a prepared proforma regarding obstetric history of the mother along with age, sex of the child, gestational age, birth weight, clinical features, general physical and systemic examination, laboratory investigation and outcome of the presenting illness if any. Investigations in form of hemoglobin, total leukocyte count (TLC), differential leukocyte count (DLC), platelet count, band Cells/neutrophil ratio, peripheral blood smear for toxic granules and dohle bodies, C-reactive protein (CRP), micro erythrocyte sedimentation rate (ESR), gastric aspirate for polymorphs, blood culture and sensitivity and blood sugar were done in all patients (8,9). Investigations such as X-ray abdomen, ultrasound cranium, CT scan brain, CSF examination, liver function tests, renal function tests, umbilical swab culture and sensitivity, vaginal swab of mother for culture and sensitivity, stool examination for occult blood and microscopy, urine routine microscopy and culture sensitivity, serum electrolytes, prothrombin time and activated partial thromboplastin time and blood group were done as and when required.

Sepsis screen used in the study had the following components: TLC, Band cells, micro ESR, gastric aspirate, CRP and absolute neutrophil count (ANC). The patients were classified on the basis of sepsis screen into the following groups: (a) True septicemia: blood culture positive, (b) Presumed septicemia: Band cells + CRP positive, (c) Suspected septicemia : Any two parameters of sepsis screen positive and (d) no septicemia: < 2 parameters of sepsis screen positive.

Results

Total 167 neonates were included in the study of which 139 (83%) were between 1-3 days old and 28 (17%) were between 3-30 days old. Signs and symptoms are present in 142 patients and 25 patients had no clinical features of sepsis. There was an obvious male preponderance with males accounting for 138 (72%) of patients. Out of these 112 (81%) patients presented within first 3 days of life while 26 (19%) presented later on. Fifty four (28%) were females out of which 41 (76%) presented early in first 3 days of life while 13 (24%) presented later in the first month of life.

Among maternal risk factors, prolonged rupture of the membranes was present in 74 (39%) mothers, followed by discharge of foul smelling liquor in 41 (21%) and more than 3 vaginal examinations in 33 (17%) of patients. Twenty nine (15%) mothers had fever more than 38°C and dai handling was present in 17 (9%) babies.

Majority of the patients in the study were preterm (108) out of which 61 (56%) were small for gestation (SGA) and 47(44%) were appropriate for gestational age (AGA). Eighty one patients (42%) were term of which 32 (40%) were SGA and 49 (60%) were AGA. Three patients were post term. On the whole 97 (51%) patients were AGA and 95 (49%) were SGA.

Common clinical manifestations were refusal to feeds in 102 (61%), respiratory distress in 89 (53%), lethargy in 66 (40%), convulsions in 49 (29%), abdominal distension in 38 (23%), hypothermia in 33 (20%), jaundice in 24 (14%) and hyperthermia in 8 (5%). Many patients in the study had more than 2 clinical features at the time of presentation.

Blood culture was positive in 52 (27%) of babies of which 37 (34%) of preterm babies, and 15 (19%) of term babies which was statistically significant (p=0.004). Presumed septicemia was present in 27 (33%) terms and 16 (15%) preterms, suspected septicemia was present in 45 (42%) preterms and 18 (22%) terms and one post term. No septicemia was seen in 10 (9%) preterms and 21 (26%) terms and 2 post terms. Organisms grown on blood culture are E.coli in 12 (23%), klebsiella pneumonia in 19 (37%), acinetobacter species in 2 (4%), staphylococcus aureus in 3 (6%), citrobacter freundii in 1 (2%), pseudomonas in 8 (15%), coagulase negative staphylococcus in 5 (10%) and yeast in 2 (4%). Association of various infections with septicemia is depicted in Table 1 and 2.

Discussion

There was a male preponderance with males in this study. This is similar to the previous studies carried out by various authors who hypothesized that incidence of septicemia was higher in males ranging from 59% - 82% due to the presence of factors regulating the synthesis of gamma globulin on X chromosome (10). In the present study, majority were preterm babies. Khatua et al reported a near similar incidence of septicemia in preterm of 63%. Various authors have attributed this to low level of IgG levels, impaired cellular immunity, compromised granulocytic functions, poor mucosal defense and inadequate activity of T and B lymphocytes to produces antibodies in preterm (10).

Maternal risk factors present were PROM, passage of foul smelling liquor and >3 vaginal examinations in our study. This is in accordance with the other studies which have reported prolonged rupture of membranes, passage of foul smelling liquor, maternal intrapartum fever >37° C and repeated vaginal examinations as the main predisposing factors for septicemia (11). In our study, common clinical feature at the time of presentation were refusal to feeds, respiratory distress and lethargy which conforms with those of previous studies (12,13). In late onset septicemia, the most common presentation was with convulsions in 71%

Table 1: Association of pneumonia, NEC with septicemia

Other infections	True Septicemia (n=52) N (%)	Presumed septicemia (n=43) N (%)	Suspected septicemia (n=64) N (%)	No septicemia (n=33) N (%)	Total N (%)
Pneumonia	33 (63)	24 (56)	19 (30)	7 (21)	83 (43)
NEC	7 (13)	5 (12)	1 (2)	0	13 (7)
Meningitis	9 (17)	6 (14)	3 (5)	0	18 (9)
Septic arthritis	2 (4)	0	0	0	2 (1)

Table 2: Co-relation of various organisms isolated with other infections

	E.coli (n=12)	Klebsi-ella (n=19)	Acineto-bacter (n=2)	S.aureus (n=3)	Citrobac-terfreun-dii (n=1)	Pseudo monas (n=8)	Coagulase-negative-staphylo coccus (n=5)	Yeast (n=2)
Pneumonia	**4**	**7**	**1**	**8**	**-**	**1**	**4**	**-**
NEC	**4(57%)**	**2(29%)**	**-**	**-**		**-**	**1(14%)**	
Meningitis	**2(22%)**	**4(44%)**	**-**	**2(22%)**	**-**	**1(11%)**	**-**	**-**
Septic arthritis	**0**	**0**	**0**	**2(100%)**	**0**	**0**	**0**	**0**

of cases followed by abdominal distension in 61% cases. This was in accordance with the study done by Shashikala et al Hubli in 1997 which stated that respiratory signs and jaundice were more common in early onset septicemia while meningitis, urinary tract infections and necrotizing enterocolitis were more common in late onset septicemia (14). Common infection in our study was pneumonia. Predominance of pulmonary pathology was observed in a study on 250 autopsies where infection was the most common cause of death (31%) of which pulmonary lesions were predominant (15). In the present study meningitis was documented in 9% of the total cases whereas it has been reported to be in between 0.3-3% (16). In the present study only 2 patients had septic arthritis. The incidence reported in various Indian studies in 1 in 1500. (17,18).

In the present study 27% cases had positive blood culture. Various authors have reported blood culture positivity in the range of 26-50% (19-23). National Neonatal Database Network (2000) has analyzed the spectrum of bacterial pathogens from different hospitals and found Klebsiella as the most common organism in 29.7% followed by S. Aureus and E.coli in 14.7% and 13.9% cases respectively (13).

In the present study pneumonia was found to be present in 43% of total cases. Out of these bacterial etiology was established in 33 cases (40%) by blood culture. This result was in accordance with study done earlier where in patients having pneumonia, blood culture came out to be positive in 36.40% cases (24) and common organisms causing pneumonia were klebsiella and staphylococcus aureus.

Present study showed NEC to be in 7% of total cases. Out of these bacterial etiology was established in 53%, and E.coli and Klebsiella were common pathogens This was in accordance with the earlier study where E. coli and Klebsiella were found out to be the most common infectious cause of NEC (25).

Conclusion

In conclusion, it may be stated that neonatal septicemia is a major cause of neonatal infections. Commonest infection associated with neonatal sepsis is pneumonia and common organisms causing pneumonia are klebsiella and staphylococcus aureus. Organisms associated with NEC are E.coli and klebsiella. Septic arthritis is associated with bacteremia and organism associated is staphylococcus aureus. Neonatal sepsis is more common in preterms.

Contributors

NKJ designed the study, analyzed & interpreted the data. DS performed the review of literature and drafted the manuscript and VM collected the data and revised the final manuscript.

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References

1. National Neonatology Forum of India. National Neonatal Perinatal Database-report for year 2002-2003, New Delhi: NNF India; 2004.
2. Rao PS, Baliga M, Shivananda PG. Bacteriology of neonatal septicaemia in a rural referral hospital in south India. J Trop Pediatr. 1993; 39: 230-233
3. Sinha N, Deb A, Mukherjee AK. Septicemia in neonates and early infancy. Indian J Pediatr. 1986; 53: 249-256
4. Sharma A, Kutty CV, Sabharwal U, Rathee S, Mohan H. Evaluation of sepsis screen for diagnosis of neonatal septicemia. Indian J Pediatr. 1993; 60: 559-563
5. Epelman M, Daneman A, Navarro OM, Morag I, Moore AM, Kim JH, et al. Necrotizing enterocolitis: review of state-of-the-art imaging findings with pathologic correlation. Radiographics. 2007; 27: 285-305
6. Singh M. Care of the newborn. 6th Ed. New Delhi. Sagar publication. 2004
7. Lewis MS, Bain BJ, Bates I. ed. Practical Hematology. Elseiver Philadelphia 10th ed. 2006.
8. Colle JG, Fraser AG, Marmion BP, Simmons AM editors. Practical Medical Microbiology. 14th ed. London: Churchil Livingstone; 1996.
9. Khatua SP, Das AK, Chatterjee BD, Ghose B, Saha A. Neonatal septicemia. Indian J Pediatr. 1986; 53: 509-514
10. Schreiber JR, Berger M. Intravenous immune globulin therapy for sepsis in premature neonates. J Pediatr. 1992; 121: 401-404
11. Saxena S, Anand NK, Saini L, Mittal SK. Bacterial infections among home delivered neonates. Clinical picture and bacteriological profile. Indian Pediatr. 1980; 17: 17-24
12. Das PK, Basu K, Chakraborty P, Bhowmik PK. Clinical and bacteriological profile of neonatal infections in metropolitan city based medical college nursery. J Indian Med Assoc. 1999 ; 97: 3-5
13. Shashikala ST, Kasturi AV, Shobha D, Krishna BVS. Clinic bacteriological study of neonatal septicemia in Hubli. Indian J Pediatr 2000;169-74.
14. Banerjee CK, Narang A, Bhakoo ON, Aikat BK.. The causes of neonatal mortality: an analysis of 250 autopsies on newborn infants. Indian Pediatr. 1975;12:1247-1252
15. Shah S, Ohlsson A, Shah V. Intraventricular antibiotics for bacterial meningitis in neonates. Cochrane Database Syst Rev. 2004; 4: CD004496
16. Narang A, Mukhopadhyay K, Kumar P, Bhakoo ON. Bone and joint infection in neonates. Indian J Pediatr. 1998; 65: 461-464
17. Bergdahl S, Ekengren K, Eriksson M. Neonatal hematogenous osteomyelitis: risk factors for long-term sequelae. J Pediatr Orthop. 1985; 5: 564-568
18. Namdeo UK, Singh HP, Rajput VJ, Kushwaha JS. Hematological indices for early diagnosis of neonatal septicemia. Indian Pediatr. 1985; 22: 287-292
19. Singh M, Narang A, Bhakoo ON. Evaluation of a sepsis screen in the diagnosis of neonatal sepsis. Indian Pediatr. 1987;24: 39-43
20. Sharma PP, Halder D, Dutta AK, Dutta R, Bhatnagar S, Bali A, Kumari S. Bacteriological profile of neonatal septicemia. Indian Pediatr. 1987; 24: 1011-1017
21. Tallur SS, Kasturi AV, Nadgir SD, Krishna BV. Clinico-bacteriological study of neonatal septicemia in Hubli. Indian J Pediatr. 2000; 67: 169-174
22. National neonatology forum of India. National Neonatal perinatal Database. Report for the year 1999-2000, New Delhi. NNF India; 2000.
23. Shakunthala SK, Mallikarjuna Rao G, Urmila S. Diagnostic lung puncture aspiration in acute pneumonia of newborn. Indian Pediatr. 1978; 15: 39-44
24. Smith MF, Borriello SP, Clayden GS, Casewell MW. Clinical and bacteriological findings in necrotising enterocolitis: a controlled study. J Infect. 1980; 2: 23-31

From: Department of Pediatrics, Himalyan Institute Hospital Trust, Rishikesh, India.

Address for Correspondence: Dr. Neeraj Jain, B1 Vasudev Residency, 32 Adarsh Gram, Dehradun Road, Rishikesh 249201, India. Email: neerajjain@vsnl.net

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