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RAPID DIAGNOSIS OF BACTERAEMIA IN INFANTS AND CHILDREN

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ABSTRACT

Clinically suspected 330 cases of Bacteraemia in neonates, infants & children admitted as inpatients at JLN Hospital and Research Centre, Bhilai & 25 healthy children as control were included in the present study. The cases were investigated by blood culture & 5 rapid tests Viz total leucocyte count (TLC), is the main defense against invading micro-organisms, which migrate to sites of inflammation, ingesting & killing foreign material or bacteria, immature to total neutrophil (I:T) ratio, which is bacteria fighting cells, C – reactive protein (CRP), ESR & Grams smears of Buffy coat for organisms. Blood cultures were positive in 141 (42.7%) of 330 cases & negative organisms was 55.3% as against 44.6% of Gram positive bacteria. The most common isolates were Staph epidermides (25.5%) and Staph aureus (17.0%) with overall staphylococcal prevalence of 42.5% followed by gram negative bacteria, S.Typhi (14.8%) E.coli & Ps. auroginosa each 10.6%.The rapid tests were evaluated in blood culture positive & negative cases CRP yielded maximum sensitivity of 80.5%, Specificity of 77.7% & positive predictive accuracy of 73.0% combination of 2 tests did not reveal any significant advantage over single CRP test.

KEYWORDS: Bacteraemia in infants & children Blood cultures, Rapid diagnostic test.

INTRODUCTION

In under developed & developing countries like India infectious diseases in infants & children continue to be of common occurrence & Bacteraemia is frequently seen with seniors complication & the problem is more prominent in children with high fever usually associated with high morbidity & mortality[1] because neonates are immunocompromised even at term gestation & neonatal immune system is functional at birth, but not mature. Clinically Bacteraemia is spread by transplacental after maternal infection & invasion of the bloodstream is the usual rout by which the foetus becomes infected, often difficult to diagnose due to presenting non specific clinical features with no noticeable focus of infection.[2] Since blood cultures are difficult in neonates, infants & very young children & usually require 2-3days for diagnosis, some rapid tests have been for early diagnosis of Bacteraemia[3] to facilitate prompt treatment. We know that some relevant clinical manifestations & lab tests would help to determine which children are at low risk of occult bactearemia & need not have their blood cultures.[4]

MATERIALS AND METHODS

The clinical materials upon which this study is based, was obtained from JLN Hospital and Research Centre, Bhilai in collaboration with CCM medical College and compressed of 330 clinically suspected cases of bacteriaemia in children with 25 healthy children serving as controls.

Blood samples were collected aseptically for different tests depending upon the age of the child. About 3 – 5ml blood was drawn from children of age 6 months and above. One ml of blood was put into a bottle containing 2mg/ml EDTA as anticoagulant for TLC, I:T neutrophil ratio and buffy coat. 1ml was allowed to clot in a sterile byou bottle for CRP and 0.5ml was collected in a sterile small test tube with 0.2ml 3.8% citrate solution for ESR. Remaining 2.3ml blood was inoculated into 20ml Trypticase soy broth (TSB) containing 0.05% liquid in Mccartney bottle. In neonates & infants finger prick blood was used for TLC, I:T ratio & atleast 1ml blood was collected and clotted in a bottle for CRP & clot culture in 10ml TSB.

The samples were immediately processed in the laboratory. Blood cultures & clot cultures were incubated at 37^0C for 10days with subcultures at 3 days intervals on blood agar & Macconkey agar. The bacterial isolates were identified by biochemical reactions & special tests.[5] TLC was made using improved Newbaur counting chamber & WBC pipette and I:T ratio in leishman's blood smears by making differential count of 100 successive neutrophils to determine nuclear indices

according number of lobes of nuclei. Grams smears of buffy coat obtained by centrifugation of EDTA blood in wintrobe tube at 2500 rpm were examined microscopically for organisms. CRP estimation was done by latex agglutination using reagents obtained from Tulip Diagnostics limited.

The cut off values for positive tests were TLC less than 5000 and more than 20000 / cmm; I:T neutrophil ratio, 0.2 and above; ESR more than 10mm of first hour; CRP more than 6mg/ml. The results of all the rapid tests were analyzed singly or in combination of 2 to asses their sensitivity, specificity and positive predictive accuracy.

OBSERVATION AND RESULT

Table no. 1: Number & percentage of different group organisms out of 141 positive blood cultures.

Organisms	Number	Percentage (%)
Gram positive isolates	76	44.44
Gram negative isolates	95	55.55
Total	171	100

Cut of 330 cultures which include blood and clot cultures, 141 (42.7%) yielded growth and all blood cultures were negative in controls (Tables 1) All positive blood cultures reveled only mono – bacterial isolates. Out of 141 cultures positive, 78 (53.3%) showed growth of gram negative bacteria and 63 (44.6%) yielded Gram positive organisms.

Table no. 2: Number & percentage of different types organisms out of 141 positive blood cultures.

Organisms	Number	Percentage (%)
Staphylococcus epidermides	42	24.56
Staphylococcus aureus	28	16.37
Salmonella typhi	25	14.61
Escherichia coli	19	11.11
Pseudomonas aeruginosa	18	10.52
Proteus mirabilis	14	08.18
Klebsiella aerogenes	12	07.01
Citrobacter freundii	07	04.09
Candida albicans	06	03.50
Total	171	100

It is also evident from Table 2 that the most common isolates were Staph epidermides (25.5%) and Staph aureus (17.0%) giving overall Staphylococcal prevalence of 42.25% followed by gram – negative bacteria which includes S.Typhi (14.8%), E.coli and Ps.auroginosa each 10.6%.

Table no. 3: Number & percentage of culture positive & negative organisms out of 330 clinically suspected inpatients.

Blood Culture	Number	Percentage (%)
Culture positive	171	46.34
Culture negative	198	53.65
Total	369	100

Table 3 shows comparisons between culture positive & culture negative isolates which is collected from Blood culture out of 330 clinical patients.

Table no. 4: Result of rapid diagnostic tests.

Test	Positive(A)	(%)	Negative(C)	(%)	Negative(B)	(%)	Positive(D)	(%)
TLC	98	57.30	73	42.69	112	56.56	86	43.43
I :T neutrophil ratio	89	52.04	82	47.95	94	47.47	104	52.52
ESR	91	53.21	80	46.78	142	71.71	56	28.28
CRP	121	70.76	50	29.23	47	23.23	151	76.26
Buffy coat smear	0	0	0	0	0	0	0	0

Table 4 shows the result of rapid diagnostic tests in 141 culture positive and 189 cultures negative cases. Gram smears of buffy coat were negative for organisms in both cultures positive and negative cases. But of 141 blood cultures positive cases abnormal values of TLC in 84 (59.5%),I:T ratio in 72 (51.0%), ESR in 75 (53.0%)and CRP in 114 (80.9%) were observed. On the other hand, 189 cultures negative cases, abnormal values TLC in 84 (44.4%), I:T ratio 102 (53.9%), ESR 54 (28.5%) and in 147 (77.7%) were noticed.

Table no. 5: Shorts percentage Sensitivity, Specificity & Positive Predictive accuracy of four rapid tests.

Test	Sensitivity (A x 100 / A +C)	Specificity (D x 100 / B + D)	Positive predictive accuracy (A x 100 / A + B)
TLC	57.30	43.43	46.66
I : T ratio	52.05	52.52	48.64
ESR	53.22	28.28	39.05
CRP	70.76	76.26	72.02
CRP + TLC	64.03	59.84	59.51
CRP + I:T ratio	61.40	64.39	59.82
CRP + ESR	61.99	52.01	52.86

The results showing sensitivity, specificity and positive predictive accuracy of 4 rapid diagnostic tests either singly or in combination of 2 tests are recorded in table 3. It is evident that CRP revealed sensitivity of 80.8%, specificity of 77.7% and positive predictive accuracy of 73.0% when compared with other tests either alone or in combination of 2 tests.

DISCUSSION AND CONCLUSION

Bacteraemia in Pediatric cases seen in hospital and clinics is of frequent occurrence with serious Sequelae. Salient clinical features and some rapid laboratory tests often help to make early diagnosis.[4] The overall smears rate of blood cultures in the present study is 42.7%. The reported positive blood cultures by different Indian workers are 50.0,[6] 60.0%,[7] 59.9%[8] and 32.0%.[9]

Our study revealed prevalence of Gram negative bacteria as high as 55.3% when compared to 44.6% prevalence of Gram positive organisms furthermore, We observed Staphylococcal predominance of 42.5% with prevalence of Staph epidermises and Staph aureus being 25.5% and 17.0% followed by S.Typhi (14.8%), E.coli and Ps aeruginosa (10.6%) each. while our study reported 4.2% isolation rate of citrobacter freundii, the present series revealed 4.2% prevalence thus indicating it as an important pathogen in bacteriaemia.

Out of 5 rapid test, significantly Gram smears of buffy coat were negative in all cases. CRP showed maximum sensitivity of 80.8%, specificity of 77.7% and positive predictive accuracy of 73.0% and these findings are in agreement with the reports of other workers.[11,12] On the other hand other rapid tests singly or in combinations of 2 did not show any advantage when compared to CRP test alone. Based on our observations, we are of the opinion that blood cultures and a battery of rapid tests could be carried out depending upon the amount of blood drawn from children of different age's groups. And if blood drawn is around 1ml only CRP test could be preferred since it is a sensitive indicator of Bacteraemia in the absence of blood cultures. Clot cultures could be done whenever possible.

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