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Estimate the Prevalence and Pattern of Serious Bacterial Infections (SBIS) in Febrile Young Infants

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Abstract: ***Aims and Objectives: To estimate the prevalence and pattern of serious bacterial infections (SBIs) in febrile young infants. Material and Methods: The study was conducted in the Postgraduate Department of Pediatrics, G.B. Pant hospital, an associated hospital of Govt. Medical College Srinagar, which is a referral tertiary care hospital for the children of Kashmir valley. The study was a prospective non-randomized study conducted from April 2011 to March 2012. All infants of age 30-89 days admitted in hospital with rectal temperature > 38◦C/100.4◦F without an apparent focus of infection on history and clinical examination were included in the study. Results: Total of 149 patients fulfilled the inclusion criteria. The prevalence of SBI in our study was 26.2% (39 out of 149 patients were positive for serious bacterial infection).Urinary tract infection in 16 which was 41.0% (out of 39 SBI's), pneumonia 9 (23.1%), Occult bacteremia 8 (20.5%) and bacterial meningitis 6 (15.4%). Conclusion: Prevalence of 26.2% of serious bacterial infection in our study was high, as our hospital is a tertiary care, referral centre for sick patients. Urinary tract infection was most common followed by pneumonia, then occult bacteremia and finally bacterial meningitis. Pneumonia in our study was 23.9% which was quite high, might be because of the fact that study happened at a colder place, which could be a risk factor for more lower airway diseases.***

Keywords: Serious bacterial infection, Platelets, Fever, Infant, Diagnosis.

1. Introduction

Febrile infants less than 3 months of age present a management challenge, as many of these have no identifiable source of fever, and the prevalence of serious bacterial infection (SBI) in this age group is high[(1,2)]. The most commonly suggested strategy is for the febrile neonates to be admitted to a hospital and undergo full sepsis workup.[(3-5)] In the past decade, several management strategies based on the combination of physical and laboratory findings have been proposed, but no protocol has been universally adopted[(6,7)]. Furthermore, a series of laboratory parameters such as white blood cell (WBC) count, absolute neutrophil count, pyuria, C- reactive protein (CRP), and more recently, interleukin-6 and procalcitonin, have been extensively evaluated and compared as potential predictors of SBI[(8,9)]. These laboratory tests lack adequate predictive ability and the idea of a simple, rapid and inexpensive diagnostic test that could accurately identify bacterial infections among febrile infants, remains unattainable [(2,4,10)]. It is not uncommon for infants to suffer from fever within the first 3 months of life. Although such fevers are typically self-limiting, it has been reported that 1–38% of afflicted infants also have serious bacterial infection (SBI)[(1,12)]. Traditionally, febrile infants younger than 90 days of age were hospitalized, received a full sepsis workup, and were treated with intravenous antibiotics until definitive culture results became available[(1,11)].Objective was to estimate the prevalence of serious bacterial infection among febrile young infants and pattern of serious bacterial infection (SBI) across the study.

2. Material & Methods

The study was conducted in the postgraduate Department of Pediatrics G.B. Pant hospital, an associated hospital of Govt. Medical College Srinagar, which is a referral tertiary care hospital for the children of Kashmir valley. The study was a prospective non-randomized study conducted from April 2011 to March 2012.

Inclusion Criteria

All infants of age 30-89 days admitted in hospital with rectal temperature > 38◦C/100.4◦F without an apparent focus of infection on history and clinical examination.

Exclusion Criteria

Infants having fever more than 72 hours, and who had received antibiotics or vaccination within 48 hours of presentation.

Approach

All patients who had fulfilled, the inclusion criteria, underwent sepsis screening including WBC count, platelet count, blood culture, urine microscopy and culture and CRP. Lumbar puncture for cerebrospinal fluid (CSF) analysis and culture, pleural tap for pleural fluid analysis and culture as well as stool culture and chest radiographs, were obtained at the discretion of the attending pediatrician.

The WBC count with differential and the platelet count were quantified using automated laboratory equipment (Sysmex KX-21). Blood cultures were monitored by an automated system (Bac T/ALERT 3D). Urine was obtained by urethral catheterization using a sterile technique. A careful urinalysis, on a fresh urine sample, can identify children with a high likelihood of UTI to enable presumptive treatment while awaiting results of urine culture, the WBC in the urine were quantified by standard microscopic examination and expressed as WBC >5 leukocytes / high power field in a centrifuged sample or >10 leukocytes / mm^3 in an uncentrifuged sample[(13)]. The urine, CSF, pleural fluid and stool cultures were monitored using standard laboratory techniques. Normal CSF was defined as, clear in colour, WBCs up to 5/mm^3, proteins 10 to 40mg/dl, glucose content about 60% of the blood glucose level in a healthy child and

polymorphonuclear cells were always taken abnormal in all patients [14].

Serious Bacterial Infection

Was defined as occult bacteremia, urinary tract infection (UTI), bacterial meningitis and pneumonia. Isolates such as Staphylococcus epidermidis in the blood culture were considered contaminants unless they were isolated from more than two consecutive cultures. Urinary tract infection was defined as growth of single known pathogen on urine culture with≥100,000 cfu/mL of urine obtained by urethral catheterization. Confirmation of the diagnosis on urine culture is necessary [13]. Definite pneumonia was defined as consolidation on chest radiograph plus any of the following signs, a positive blood culture for a pathogenic organism or culture of a pathogenic organism from pleural fluid sample. Probable pneumonia was defined as consolidation alone[15].

Occult bacteremia was defined as a pure growth of a single pathogenic micro-organism on blood culture of a febrile young infant without any apparent focus of infection on history and clinical examination. Probable bacteremia was defined as the growth of two or more types of bacteria[15]. Definite bacterial meningitis was defined as isolation of organism on CSF culture. Probable bacterial meningitis was defined as abnormal CSF on analysis with sterile CSF culture[14]. Only patient with definite bacterial infection, was taken as serious bacterial infection.

3. Observation

Total number of admissions to hospital during the period were 25640. Total number of patients with fever without an apparent focus of infection on history and clinical examination, admitted to hospital was 180 . Total number of patients fulfilling the inclusion criteria was 149. 31 patients out of 180 were excluded out of the study, as among these, 12 had fever for more than 72 hours, 3 had received vaccination, 16 were treated with antibiotics within 48 hours of presentation.

Table 1: Showing gender with respect to age:

Age and gender distribution of the febrile Patients							
Age (day)	Male		Female		Total		p value
	N	%	N	%	N	%	
30 to 59	31	41.3	39	52.7	70	47.0	0.166 (NS)
60 to 89	44	58.7	35	47.3	79	53.0	
Total	75	50.3	74	49.7	149	100.0	
Median	66 (30, 89)		58 (30, 84)		61 (30, 89)		

Total number of males between 30-59 days of age was 41.3% and females was 52.7%, total number of males between 60-89 days of age was 58.7% and females was 47.3% and Median age of males was 66(30,89) days and of Females was 58(30,84) days which was non-significant across the study with P value ≥ 0.05 .

Table 2: Showing various investigations across febrile young infants

Variable	Mean	Median
Temperature◦ F	102.6 ±1.1(101,105)	103
Hemoglobin (gm%)	12.0 ±2.4(8.6,19.2)	11.6
Total Leucocyte Count (000's)	12079 ±5039(5200,29000)	11000
DLC_P%	50.6 ±17.7(19,82)	50
DLC_L%	43.6 ±17.3(15,80)	45
DLC_M%	5.7 ±5.3(0,25)	5
Platelet Count (lakh)/mm^3	4.2 ±1.5 (0.4, 7.5)	4.3

This table shows mean ,±1SD, lowest and highest values of each investigation and median across febrile young infants. Mean ±1SD of temperature ◦F was 102.6◦F ± 1.1, Hemoglobin 12.0 ± 2.4, Total Leucocyte Count 12079 ±5039 and Platelet count 4.2 lakh/mm^3 ±1.5 across febrile young infants .

Table 3: Depicting investigations across Febrile Young Infants

Investigation		*N*	*%*
Thrombocytosis>4lakh/mm3		93	62.4
TLC ≥15000/mm3		44	29.5
C-Reactive Protein ≥2mg/dl		35	23.5
Blood Culture	Sterile	140	94.0
	Escherichia Coli	1	0.7
	Klebsiella	2	1.3
	Methicillin Resistant Staphaureus	3	2.0
	Staphylococcus Aureus	3	2.0
Urine Examination for Pus Cells	> 5	31	20.8
	≤ 5	118	79.2
Urine Culture	Sterile	133	89.3
	Escherichia Coli	11	7.4
	Klebsiella	5	3.4
CXR for Pneumonia	+Ve	9	6.0
Pleural Fluid culture	+Ve	9	6.0
CSF Analysis	Abnormal	6	4.0
	Normal	99	66.4
	Not done	44	29.5
CSF Culture (n=105)	Sterile	99	94.3
	Group B Streptococcus	2	1.9
	Escherichia Coli	2	1.9
	Methicilline Resistant Staphylococcus aureus	2	1.9
Stool culture	+Ve	0	0.0

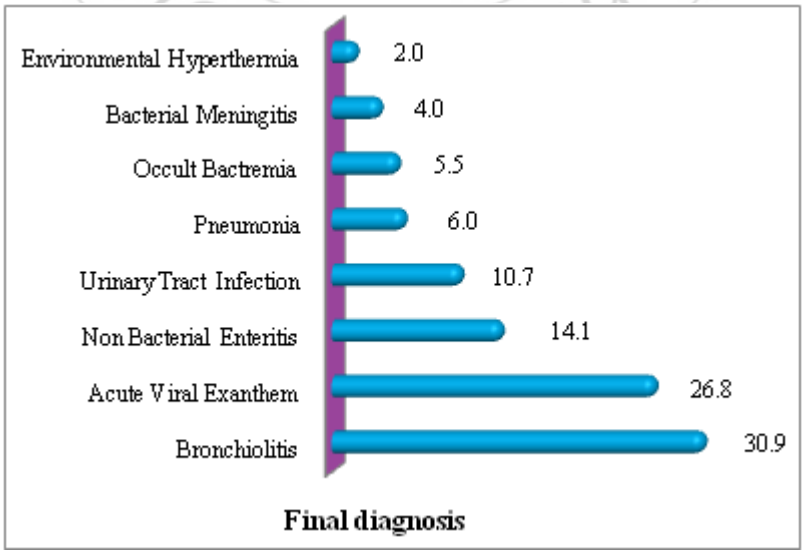
Thrombocytosis >4lakh/mm^3 was positive in 93 (62.4%) , TLC ≥15000/mm3 in 44 (29.5%), C-Reactive Protein ≥ 2mg /dl was in 35 (23.5%), Blood Culture in 9 (6%) , Urine Examination for Pus Cells > 5 cells in 31 (20.8%) , Urine Culture 16 (10.7%) , CXR for Bacterial Pneumonia and Pleural Fluid Analysis / culture for separation of pathogen responsible for bacterial pneumonia were in 9 (6%) , CSF Culture was positive in 6 (4%) and Stool culture was positive in nil , in one patient Escherichia Coli was isolated in both urine culture and blood culture, three contaminated blood cultures of Staphylococcus epidermdis were also noted. There was no case of bacterial pneumonia positive for blood culture.

Table 4: Depicting the final diagnosis labeled to patients.

Diagnosis	N	%
Pneumonia	3	2.0
Non Bacterial Enteritis	21	14.1
Bronchiolitis	41	27.5
Bacterial Meningitis	4	2.7
Occult Bacteremia	8	5.4
Environmental Hyperthermia	3	2.0
Hydronephrosis with Urinary Tract Infection	1	0.7
Faulty Feeding with Pneumonia	2	1.3
Faulty Feeding with Bacterial Meningitis	2	1.3
Downs Syndrome with TGA with Bronchiolitis	2	1.3
Moderate Pulmonary Artery Hypertension with TR with Bronchiolitis	1	0.7
Cerebral Palsy with Pneumonia	2	1.3
Acute Viral Exanthem	37	24.8
Urinary Tract Infection with Occult Bacteremia	1	0.7
Faulty Feeding with Acute Viral Exanthem	3	2.0
Spino-muscular Atrophy with Pneumonia	2	1.3
Urinary Tract Infection	14	9.4
Downs Syndrome with Bronchiolitis	2	1.3

Table 5: Depicting infectious causes of illness in febrile young infants.

Final diagnosis	%
Bronchiolitis	30.9
Acute Viral Exanthem	26.8
Non Bacterial Enteritis	14.1
Urinary Tract Infection	10.7
Pneumonia	6.0
Occult Bacteremia	5.5
Bacterial Meningitis	4.0
Environmental Hyperthermia	2.0



Graph 1: Depicting infectious causes of illness in febrile young infants

Table 6: Showing total SBI and Non-SBI across study

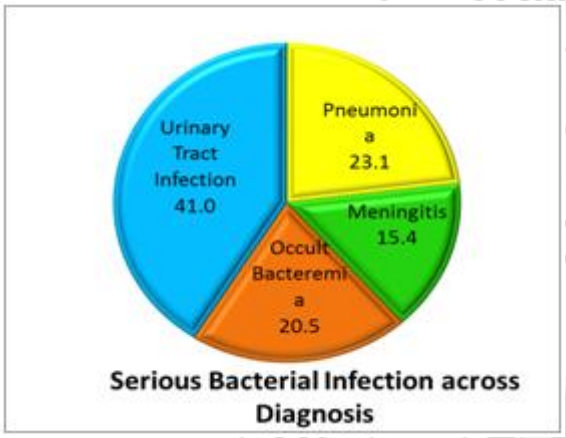
SBI	N	%
Present	39	26.2
Absent	110	73.8

Table 7: Depicting serious bacterial infection in febrile young infants

Final diagnosis	%
Urinary Tract Infection	10.7
Pneumonia	6.0
Occult Bacteremia	5.5
Bacterial Meningitis	4.0
Non-SBI	73.8

Table 8: Depicting serious bacterial infection across diagnosis.

Serious Bacterial Infection across Diagnosis	%
Pneumonia	23.1
Meningitis	15.4
Occult Bacteremia	20.5
Urinary Tract Infection	41.0



Graph 2: Depicting serious bacterial infection across diagnosis

Table 9: Comparing investigations across SBI and Non-SBI (MRSA: Methicillin-resistant Staphylococcus aureus; E.Coli : Escherichia Coli)

Variable		*Serious Bacterial Infection*				*p value*
		+Ve		*-Ve*		
		n	*%*	*N*	*%*	
Blood Culture	Sterile	30	21.4	110	78.6	<0.05(Sig)
	E. Coli	1	100.0	0	0.0	
	Klebsiella	2	100.0	0	0.0	
	MRSA	3	100.0	0	0.0	
	Staphcoccus Aureus	3	100.0	0	0.0	
Pyuria	> 5	25	80.6	6	19.4	<0.05(Sig)
	≤ 5	14	11.9	104	88.1	
Urine Culture	Sterile	23	17.3	110	82.7	<0.05(Sig)
	E. Coli	11	100.0	0	0.0	
	Klebsiella	5	100.0	0	0.0	
CXR for Pneumonia	+Ve	9	100.0	0	0.0	<0.05(Sig)
Pleural fluid Analysis/ culture	+Ve	9	100.0	0	0.0	<0.05(Sig)
CSF Analysis	Abnormal	6	100.0	0	0.0	<0.05(Sig)
	Normal	28	28.3	71	71.7	
	Not done	5	11.4	39	88.6	
CSF Culture	Sterile	28	28.3	71	71.7	<0.05(Sig)
	Group B Streptococcus	2	100.0	0	0.0	
	E. Coli	2	100.0	0	0.0	
	MRSA	2	100.0	0	0.0	

Blood culture was positive in 9 SBI patients ,urine culture 16 , CSF culture 6, chest X-ray suggestive of bacterial pneumonia and Pleural fluid analysis /culture for isolation of pathogen responsible for bacterial pneumonia in 9 .

4. Discussion

Total number of patients fulfilling the inclusion criteria were 149. The prevalence of SBI in our study was 26.2% (39 out of 149 patients were positive for serious bacterial infection), Allen L. Hsiao et al.[2] studied 429 infants out of which 44 (10.3%) patients were diagnosed with serious bacterial infection, in another study Pulliam PN et al.[16] studied seventy-seven patients and they enrolled SBI in 18% of the patients and Annick Galetto-Lacour et al.[17] studied 99 patients and noticed serious bacterial infection in 29%. Prevalence of SBI was quite high in our study which was conducted at a tertiary care, referral centre, to which more sick patients are referred, so this can be the reason for high prevalence of SBI in our study .The total number of males in this study was 75 (50.3%) and females 74 (49.7%),SBI was reported in 20 (26.7%) males and 19 (25.7%) females, P value > 0.05 , so gender by itself was not a risk factor for SBI ,another study by Allen L. Hsiao et al. [2] studied that gender distribution among SBI, of 218 male infants , 23 (10.6%) had SBI compared with 21 (10.0%) of 211 female infants , this study also showed no gender bias**.** All 149 patients 30 – 89 days old were divided into two age groups 30-59 days old and 60 -89 days old, there were 23 patients in SBI and 47 in Non-SBI of 30-59 days age, and 16 in SBI and 63 of Non-SBI of 60 – 89 days age. There was almost equal distribution of the patients, of 30-59 and 60-89 days of age across SBI, so SBI was independent of age groups across study, P value > 0.05, another study conducted by Allen L. Hsiao et al.[2] showed that the youngest infants in the study, 57–89 days of age, were not statistically significant more likely to have SBI compared with the oldest infants, who were 150–179 days of age (8.8% vs12.9%), and were no more likely than those aged 120–149 days.

Total number of SBI in our study was 39 (26.2%) out of 149 studied patients. Urinary tract infection in 16, which was 41.0% (out of 39 SBI's), pneumonia 9(23.1%), Occult bacteremia 8 (20.5%) and bacterial meningitis 6 (15.4 %). Urinary tract infection was most common followed by pneumonia, then occult bacteremia and finally bacterial meningitis ,another study conducted by S Fouozas et al.[18] had also shown urinary tract infection as the most common SBI with 88 (85.4%) out of 103 followed by occult bacteremia 9 (8.7 %) then pneumonia 6 (5.8%) and bacterial meningitis 2 (1.9 %).

In this study total number of SBI with urinary tract infection was 16 (41.02%) Escherichia coli was positive in 11 (68.8%) and klebsiella in 5 (31.2%), study conducted by S Fouozas et al.[18] had also shown Escherichia coli as the

major pathogen responsible for urinary tract infection, 74 patients out of 88 (84.1% patients). In our study 16 patients had urinary tract infection (out of 39 SBI), 9 (56%) were males and 7 (43.8%) patients were females, so urinary tract infection was more common in males than in females also, all the male patients in our study were uncircumcised, in another study by Allen L. Hsiao et al. [(2)] they noticed that of the 217 male infants with urine cultures, circumcision status was recorded in 178. Fifty (28.1%) were uncircumcised, whereas 128 (71.9%) were circumcised. Of the uncircumcised males, 36% had bacteruria compared with 1.6% of the circumcised males, which was statistically significant (p value <0.05). There was 1 case of bacteruria among the male infants of undocumented circumcision status. He also noticed bacteruria only in 9.7% of female infants, meaning that urinary tract infection was more common in males than in females and that too in uncircumcised males, so the results of this study were in concurrence to that of our's. Incidence of pneumonia in our study was 23.9% (9 out of 39 SBI), which was quite high in comparison to another study by S Fouozas et al.[(18)] in which incidence was 5.8% (6 out of 103 SBI), high incidence in our study could be because of the topographic features of the place of study.

5. Conclusion

Total number of patients fulfilling the inclusion criteria was 149. The prevalence of SBI in our study was 26.2% (39 out of 149 patients were positive for serious bacterial infection). SBI was independent of age, gender and residence, P value insignificant. Urinary tract infections were most common 41.0% followed by pneumonia 23.1%, then occult bacteremia 20.5% and finally bacterial meningitis 15.3%. E. coli was most common pathogen for UTI, positive in 68.8%. UTI was more common in males 56% versus females 43.8%. Incidence of pneumonia in our study was 23.9% which was quite high, might be because of the fact that study happened at a colder place, which could be a risk factor for more lower airway diseases.

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