Global Academic Journal of Medical Sciences

Available online at www.gajrc.com
DOI: 10.36348/gajms.2021.v03i04.002

ISSN: 2706-9036 (P)
ISSN: 2707-2533 (0)

Original Research Article

Evaluation of the Impact of Bacterial Antigen Detection in CSF in the Diagnosis of Meningitis

Dr. Saukat Ara Begum[1*], Dr. Roushan Iqbal[2]

[1]Associate professor, Department of Paediatric, Shahid Taj Uddin Ahmed Madical College, Gajipur, Bangladesh
[2]Senior Medical Officer, Department of Surgery, BERDEM Hospital, Dhaka, Bangladesh

***Corresponding Author**
Dr. Saukat Ara Begum

Article History
Received: 13.06.2021
Accepted: 10.07.2021
Published: 05.08.2021

Abstract: ***Introduction:*** Bacterial meningitis is a common clinical problem among the infants and children in Bangladesh. Delay in distinguishing bacterial from non-bacterial meningitis may terminate into fatal consequences. ***Aim of the study:*** The aim of the study is to evaluate the impact of bacterial antigen detection in cerebrospinal fluid (CSF) in the diagnosis of meningitis. ***Materials & Methodology:*** This cross-sectional study was carried out in the Department of Paediatrics, Bangabandhu Sheikh Mujib Medical University (BSMMU) and Department of IImmunology, Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic disorders (BIRDEM). Subjects were recruited randomly from the Department of Paediatrics, BSMMU, Department of Paediatric, Dhaka Medical College Hospital (DMCH) and Paediatric Medicine Unit, Dhaka Shishu (Childern's) Hospital during 1996 to 1997. A total 40 subjects clinically suffering from meningitis were selected randomly with inclusion and exclusion criteria.All data were analyzed by using SPSS program (SPSS for Windows, Release 7.5) and expressed as mean ± SD or in frequency or percentage unless mentioned otherwise. ***Results:*** The bacterial antigens were positive only in the bacterial group (Haemophilus influenzae 42.1%, p = 0.001: Streptococcus pneumoniae 21.1%, p = 0.069; Nesseria meningitidis group B/Escherechia coli Kl 5.3%, p=0.645 and Nesseria meningitidis group C 5.3%, p=0.645). For all the three meningitis of bacterial antigen (p = 0.053), multiple regression showed significant relation in age, history of respiratory tract infection, drug history, neurological deficit, total count, CSF cell count, CSF glucose, CSF protein, gram stain and AFB stain, CSF culture and bacterial antigen. ***Conclusion:*** Bacterial antigen has positive impact only in Bacterial meningitis in the present study. Detection of bacterial antigen in CSF helps to separate bacterial from tubercular and viral meningitis. In short, bacterial antigen in CSF alongwith biochemical and cytological features of CSF are very much helpful in distinguishing different types of meningitis and their appropriate management.

Keywords: Bacterial Antigen; CSF; Meningitis.

INTRODUCTION

Bacterial meningitis is a common clinical problem among the infants and children in Bangladesh. Delay in distinguishing bacterial from non-bacterial meningitis may terminate into fatal consequences [1]. A typical case of bacterial meningitis without prior antibiotic therapy can easily be distinguished from non-bacterial meningitis by conventional biochemical and bacteriological studies of cerebrospinal fluid (CSF). However, prior treatment with inappropriate and inadequate antibiotics may cause alteration in biochemistry and cytology of CSF as well as of the causative organisms and the diagnosis may be

delayed [2]. Concerning the most frequent meningitis agents such as Haemophilus influenzae, Streptococcus group B, Streptococcus pneumoniae, Neisseria meningitidis and Escherichia coli, rapid methods to detect soluble antigens in cerebrospinal fluid (CSF) have been reported [3, 4]. Bacteria liberate capsular polysaccharide into the body fluids during infection [5]. Although antigen detection methods do not replace traditional bacteriologic techniques, they are usually more sensitive and specific than the interpretation of a gram-stained smear [5]. Gram positive bacteria can appear gram negative because of the action of anti-bacterial agents on the cell wall leading to miss interpretation of the gram-stain. Very frequently, culture results are adversely affected by prior anti-microbial therapy [6]. Furthermore, results of antigen detection test are available at least 18 hours before culture results. The collection and transport conditions of the biological material to be processed may also affect the results of a culture, which depends on variable organisms [7]. Several methods to determine the cause of bacterial meningitis within the shortest possible time have been described. Numerous assay and commercial kits including counter immune electrophorosis, coagulation test and latex particle agglutination were rapidly developed to serve as adjuncts to routine culture and gram staining [8-12]. In recent years, bacterial antigen test has been dramatically affected by changes in infectious disease epidemiology and improvements in therapeutics. During this era, chloramphenicol was used as empiric therapy for meningitis to ensure adequate coverage against β-lactamase producing Haemophilus influenzae type b. Because of the toxicity associated withchloramphenicol use in children, bacterial antigen testing was deemed particularly important in this setting to detect H. influenzae in CSF would in many cases lead to the early discontinuation of chloramphenicol [13]. Werner and Kruger achieved 100% sensitivity in patients, using a WBC count of ≥50 cell per mm3 as a criterion for performing bacterial antigen test [4]. Others have used both higher and lower cell counts with similar results [4, 14]. In applying any biochemical or cytological criterion for screening CSF, there is always the argument that prior antibiotic therapy will alter the CSF picture. Detection of bacterial antigen may be used as an important diagnostic tool under these circumstances. The aim of the study is to evaluate the impact of bacterial antigen detection in cerebrospinal fluid (CSF) in the diagnosis of meningitis.

OBJECTIVES

The objective ofthis study was toevaluate the impact of bacterial antigen detection in cerebrospinal fluid (CSF) in the diagnosis of meningitis.

MATERIALS & METHODOLOGY

This cross-sectional study was carried out in the Department of Paediatrics, Bangabandhu Sheikh Mujib Medical University (BSMMU) and Department of IImmunology, Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic disorders (BIRDEM). Subjects were recruited randomly from the Department of Paediatrics, BSMMU, Department of Paediatric, Dhaka Medical College Hospital (DMCH) and Paediatric Medicine Unit, Dhaka Shishu (Childern's) Hospital during 1996 to 1997. A total 40 subjects clinically suffering from meningitis. 10 age matched control subjects were collected irrespective of sex from the above institutions. Patients were selected randomly on their fulfillment of the inclusion & exclusion set criteria. Recruitment was done on alternate weeks from Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka Medical College Hospital (DMCH) and Dhaka Shishu (Childern's) Hospital. On recruitment of each patient, a detailed history was taken from parents or guardians and thorough clinical examination was done. All data were collected in a prescribed data collection sheet as shown. Following the clinical examination 2 ml of blood was collected aseptically from the anticubital vein using a disposable syringe in a plain glass test tube. Blood was kept at room temperature to clot and centrifuged to separate serum within 2 hours. Cerebro-spinal fluid was collected under highly aseptic method by performing lumber puncture. All lumber puncture were performed byAssistant Registrar of the respective institution. About 0.5 ml of CSF was collected in a previously autoclaved microcentrifuse tube. It was labeled properly and preserved at -30°C until analysis for CSF and bacterial antigen test. For control subjects' serum and CSF was collected in the same way. Findings of routine test of blood and CSF were collected on the next visit. Patients continued their usual treatment as advised by the respective physician. A follow up was made and noted on another visit.Analysis of CSF and detection of bacterial antigen in the CSF was done in the Department of Immunology of BIRDEM. Whereas routine haematological test and cytology, biochemistry and bacteriology of the CSF were done in the department of pathology of the respective institution.CSF were estimated by using commercial kit. Bacterial antigen released in CSF was detected by using commercial sensitized bacterial antigen

latex kit.All data were analyzed by using SPSS program (SPSS for Windows, Release 7.5) and expressed as mean ± SD or in frequency or percentage unless mentioned otherwise. Comparison between groups was done by analysis of variance (ANOVA), Chi-square, Kruskal Wallis 1-way ANOVA. Student's t-test, or Multivariate analysis, as applicable. Relationship among variables was calculated by Linear or Spearman's correlation. P value ≤ 0.05 was considered as the level of significance. For statistical calculation, if variable(s) of any patient was incomplete, that patient was dropped out from the specific group of patients for that calculation.

Inclusion Criteria

1. Children of age 1 month to 12 years of any sex with suspected meningitis.
2. Clinically positive meningeal signs irrespective of previous antibiotic therapy.
3. Children fit for age and who were neither suffering nor simulate features of meningitis.
4. Children who underwent lumber puncture for purpose other than meningitis.

Exclusion Criteria

- Age less than 1 month or more than 12 years.
- Presence of any other systemic disease.
- Recent history of trauma or surgery.
- Suspected meningitis who was proved not to have the disease after LP.

RESULTS

From a total 40 study subjects meningitis the mean±sd found from the age (months) of our study was 29±10 years in bacterial, 23±7 in viral, 59±13 in tubercular and 51±13 in control group. A higher prevalence of meningitis was seen in the male patients in bacterial 12(30%) viral 11(27.5%) as well as female subjects 7(17.5%) found in both bacterial and tubercular. 4(10%) female found in viral and lowest 2(5%) male found in tubercular. 5(12.5%) both male and female found in control group. Neek rigidity and Kernig's sing was found positive 16 study subjects in bacterial, 11 in viral, 5 in tubercular and 3 in control group in both variable (Table-I). Majority of the children with bacterial (47.4%) and tubercular (50%) meningitis presented with drowsiness but in viral (53.3%) with vacant look whereas most of the control children (40 %) with irritable appearance (p = 0.0144). In all the four groups, frequencies of children reluctant to feeding were high (p=0.1844). Frequency of high intermittent fever was more in viral group (60%) but all the control (100%) and most of the bacterial (42.1%) and tubercular (50%) cases had low grade fever (p = 0.0031). Convulsion / tremor was highest in the viral (93.3%) followed by bacterial (84.2%), tubercular (83.3%) and control (50%) group (p = 0.0564). Fontanale closer is related to age, but in the studied groups no statistical difference (p = 0.1893) was observed for failure of closure of fontanale. Otitis media was observed only in bacterial group (26.3%) and skin rash in viral (16.7%) and bacterial (10.5%) groups only (Table-II). General health (p = 0.1705), grade of anaemia (p = 0.4869), pulse (p = 0.2774). systolic (p=0.7513) and diastolic (0.1479) blood pressure, temperature (p = 0.4882) was statistically similar in all the groups including control. Spleen was palpable in one viral (6.7%) and in one control (10%) subject only (p = 0.5208) while liver was palpable in 40% of control, 33.3% of tubercular, 15.8% of bacterial and 6.7% of viral meningitis (p = 0.1686). A significant number of tubercular cases (83.3%) had palpable lymphnodes which was 20% in control subjects, 5,3% in bacterial cases and none in viral cases (p = 0.00002). Neck rigidity was highest in bacterial (84.2%) followed by tubercular (83.3%), viral (73.3%) and control (30.3%) subjects (p = 0.0183); and frequency of kernig's sign was exactly the same (p = 0.0183) as that for neck rigidity (Table-III). All the tubercular (100%) and most of the control subjects (90%) had past history of illness which were significantly higher (p = 0.0062) than bacterial (57.9%) and viral (33.3%) groups. History of respiratory tract infection was more common in bacterial group (68.4%) followed by tubercular (50%) and viral (40%) meningitis which was only 10% in control subjects (p = 0.0253). All the groups had statistically similar frequency of patients with drug history (p = 0.3321). Family history of tuberculosis was observed only in tubercular group (33.3) whereas vaccination was done in 84.2% of bacterial group, 73.3% in viral group and 80% in control group but only 16.7% in tubercular group (p = 0.0126) (Table-IV). In the haematological findings, haemoglobin level (gm/dl; mean ± SD) was 9.7±1.7 in viral, 8.9±1.8 in control, 8.1±1.3 in tubercular and 7.8±1.8 in the bacterial group (p=0.016). ESR (mm in 1st hour) is highest in tubercular (80±25), followed by bacterial (72±29), and similar in viral (38±26) and control (38±14) groups (p=0.000). Total count (p=0.821), cosinophil (p=0.314) and basophil (p=0.806) count were statistically similar among the different groups, whereas polymorphs (p=0.085) and lymphocytes (p=0.068) reached border line significance for difference among different groups.CSF glucose level (mg/dl, mean ± SD) was highest in viral group (52 ± 10) followed by control group (50 ± 7), bacterial group (49 ± 17) and tubercular group (44 ± 9) and statistically there was

significant difference among these groups (p = 0.016). Protein (mg/dl, mean ± SD) concentration in CSF was highest in bacterial group (223 ± 205) and lowest in tubercular group ((68 ± 38); whereas in control that was 106 ± 94 and in viral group 71 ± 56; there was statistical difference among these groups (p = 0.010). Cell type in CSF was predominantly lymphocyte in tubercular group (83.3%), control group (70%) and in viral group (60%); whereas predominance in bacterial group was polymorphs (42.1%) and mixed cells (42.1%). There was again statistical difference among the four groups (p = 0.002) (Table-V). All antigens were positive only in the bacterial group (Haemophilus influenzae 42.1%, p = 0.001: Streptococcus pneumoniae 21.1%, p = 0.069; Nesseria meningitidis group B/Escherechia coli Kl 5.3%, p=0.645 and Nesseria meningitidis group C 5.3%, p=0.645) (Figure-I). No statistical difference was observed for gram stain (p = 0.911) with CSF culture result (Figure-II). But it was significantly different for bacterial antigen (p = 0.007) (Figure-III). Multiple regression analysis for bacterial antigen the probable variables were age, history of respiratory tract infection, drug history, neurological deficit, total count, CSF cell count, CSF glucose, CSF protein, gram stain and AFB stain, CSF cultureand bacterial antigen. For all the three factors of bacterial antigen (p = 0.053), multiple regression showed significant relation in context to the above-mentioned variables. Further, in the case of drug history (p = 0.049), CSF protein (p = 0.001) were independent variables, whereas those for bacterial antigen (p = 0.098) and for bacterial antigen, they were drug history (p = 0.051), CSF glucose (p = 0.035) and CSF culture (p = 0.036) (Table-VI).

Table-I: Demographic characteristics of the study subjects (N=50)

Character	Bacterial(n=19)	Viral(n=15)	Tubercular(n=6)	Control(n=10	P
Age (months) mean ± SE	29 ± 10	23 ± 7	59 ± 13	51 ± 13	0.17
Sex (M / F)	12/7	11/4.	2/7.	5/5.	0.336
Neek rigidity (+ve / -ve)	16/3	11/4	5/1	3/7.	0.018
Kernig's sing (+ve / -ve)	16/3	11/4	5/1	3/7.	0.018

Table-II: Frequencies of different symptoms in different meningitis group (N=40).

Variables	Groups								
	Bacterial		Viral		Tubercular		Control		P
n	19	%	15	%	6	%	10	%	
Appearance									
III looking	1	5.26	1	6.67	1	16.67	3	30	0.0031
Irritable	3	15.79	3	20.00	1	16.67	4	40	
Vacant	4	21.05	8	53.33	1	16.67	1	10	
Drowsy	9	47.37	3	20.00	3	50.00	2	20	
Unconscious	2	10.53	0	0.00	0	0.00	0	0	
Reluctant to feed	18	94.74	15	100.00	6	100.00	8	80	0.1844
Fever									
Low grade	8	42.11	6	40.00	3	50.00	10	100	0.0031
High intermittent	5	26.32	9	60.00	2	33.33	0	0	
Continuous	4	21.05	0	0.00	1	16.67	0	0	
Termor/Convulsion	16	84.21	14	93.33	5	83.33	5	50	0.0564
Fontanale unclosed	14	73.68	9	60.00	2	33.33	4	40	0.1893
Fontanale bulged	13	68.42	7	46.67	0	0.00	3	30	0.0257
Fontanale not bulged	1	5.26	2	13.33	2	33.33	1	10	
Otitis media	5	26.32	0	0.00	0	0.00	0	0	0.0285
Skin rash	2	10.53	1	6.67	0	0.00	0	0	0.0632

Table-III: Frequency of different sign in various meningitis

Variables	Groups								
	Bacterial(n=19)		Viral(n=15)		Tubercular(n=6)		Control(n=10)		P
n	n	%	n	%	n	%	n	%	
General Health									
Poor	10	52.63	6	40.00	6	0.00	4	40	0.1705
Average	9	47.37	8	53.33	0	100.00	6	60	
Good	0	0.00	1	6.67	0	0.00	0	0	
Anaemia	18	94.74	13	86.67	6	0.00	8	80	0.4869
Spleen (palpable)	0	0.00	1	6.67	0	100.00	1	10	0.5208
Liver (palpable)	3	15.79	1	6.67	2	0.00	4	40	0.1686
Lymph node	1	5.26	0	0.00	5	33.33	2	20	0.0002
Neek rigidity	16	84.21	11	73.33	5	83.33	3	30	0.0183
Kering's sing	16	84.21	11	73.33	5	83.33	3	30	0.0183
Pulse(beat/min; mean±SD)	117 ± 21		112 ± 20		102 ± 9		106 ± 17		0.2774
Systolic BP(mm Hg; mean±SD)	87 ± 7		86 ± 12		90 ± 7		88 ± 10		0.7513
Diastolic BP(mm Hg; mean±SD)	56 ± 5		56 ± 5		58 ± 4		61 ± 6		0.1479
Temerature (F; mean±SD)	100.7 ± 1.5		100.7 ± 1.4		100 ± 0.6		100.1 ± 1.1		0.4882

Table- IV: Clinical history in different meningitis subjects (N=40)

Variables	Groups				
	Bacterial	Viral	Tubercular	Control	P
n	19	15	6	10	
H/O Past illness	11 (57.9)	5 (33.3)	6 (100)	9 (90.0)	0.0062
H/o Res. Tract infection	13 (68.4)	6 (40.0)	3 (50.0)	1 (10.0)	0.0253
Family H/O TB	0	0	2 (33.3)	0	0.0016
Drug history	8 (44.4)	8 (53.3)	3 (50.0)	8 (80.0)	0.3321
H/O Vaccination	16 (84.2)	11 (73.3)	1 (16.7)	8 (80.0)	0.0126

Table-V: Haematological as well as biochemical and cellular findings of CSF in different types of meningitis (mean ± SD)

Character	Bacterial	Viral	Tubercular	Control	F/x2	P
n	19	15	6	10		
In blood						
Haemoglobinc (mg/dl)	7.8 ± 1.8	9.7 ± 1.7	8.1 ± 1.3	8.9 ± 1.8	3.795	0.016
ESR (mm in 1st hour)	72 ± 29	38 ± 26	80 ± 25	38 ± 14	8.642	0
Total count (/mm3)	11763 ± 2989	12807 ± 2259	13083 ± 2417	12670 ± 6875	0.306	0.821
Polymorphs (%)	66 ± 14	69 ± 20	51 ± 13	50 ± 21	2.351	0.085
Lymphocyte (%)	29 ± 13	38 ± 19	46 ± 13	44 ± 22	2.351	0.068
Esonphil (%)	3 ± 1	2 ± 1	2 ± 1	4 ± 3	1.218	0.314
Basophil (%)	1 ± 1	1 ± 1	0	1 ± 1	0.326	0.806
Monocyte (%)	3 ± 2	1 ± 1	2 ± 1	3 ± 3	2.488	0.072
In CSF						
Glucose (mg/dl)	44 ± 17	52 ± 10	49 ± 9	50 ± 7	3.808	0.016
Protein (mg/dl)	223 ± 205	71 ± 56	68 ± 38	106 ± 94	4.215	0.01
Predominant	8 (15.8)	0	0	0	25.811	0.002
Lymphocyte (%)	3 (15.8)	9 (60.0)	5 (83.3)	7 (70.0)		
Mixed	8 (42.1)	6 (40.0)	1 (16.7)	2 (20.0)		

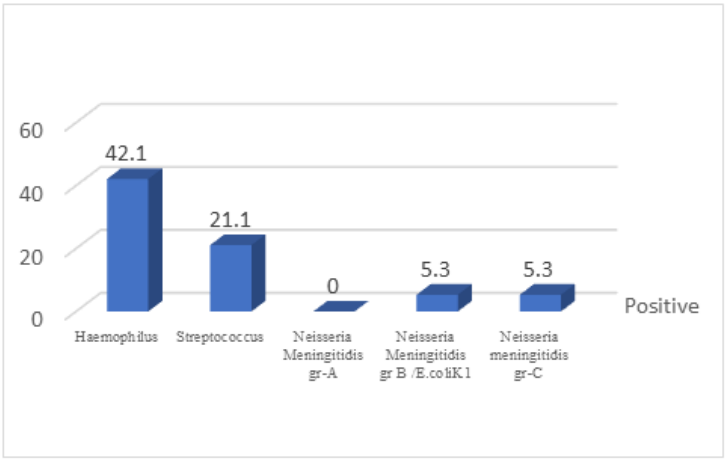

Figure-I: Positive bacterial antigen (H.influenzae, S pneumoniae, Neisseria meningitis Group=A, Neisseria Meningitis Group-B E.coliK1, Neisseriameningitidis Group-C) in Bacterial meningitis.

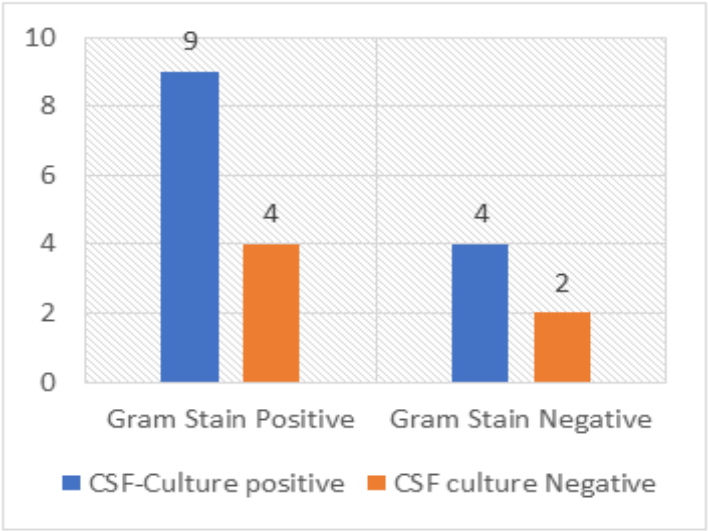

Figure-II: Diparity of culture with gram stain in Bacterial Meningitis

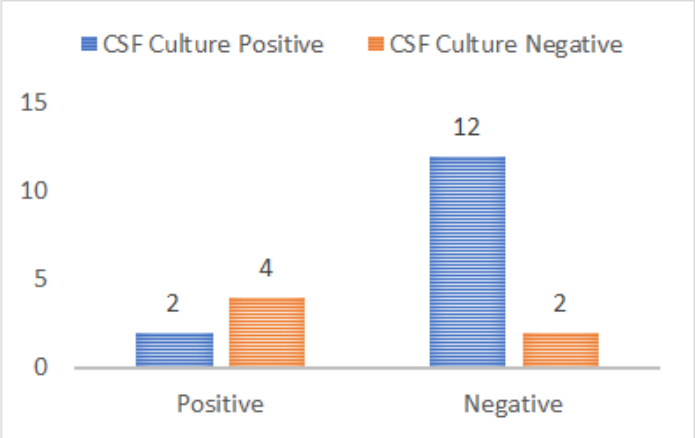

Figure-III: Positive Bacterial antigen in comparison to CSF culture

Table-VI: Multiple regression analysis of Bacterial Antigen

ANOVA	Sum ofsqures	df	Meansqures	F	P
Regression	3.308	12	0.276	4.544	0.053
Residual	0.303	5	6.07E+01		
Total	3.611	17			

Variables	B	SE	Beta	t	p
Age	-1.69E-03	0.003	-0.168	-0.574	0.591
H/O Respiratory tract infection	-0.128	0.336	-0.135	-0.381	0.719
Drug history	-0.746	0.292	-0.827	-2.553	0.051
Neurological deficit	-7.29E-02	0.302	-0.051	-0.241	0.819
Total count in PBF	1.68E-02	0	0.112	0.436	0.681
CSF cell count	5.29E-05	0	0.215	0.824	0.447
CSF Glucose	-1.82E-02	0.006	-0.673	-2.872	0.035
CSF Protein	-1.05E-03	0.001	-0.474	-1.227	0.274
Gram stain & AFB stain	-0.24	0.176	-0.252	-1.36	0.232
CSF culture	-0.509	0.179	-0.536	-2.837	0.036
Serum-CRP	1.47E-03	0.001	0.655	1.557	0.18
CSF-CRP	-2.48E	0.008	-0.065	-0.318	0..764
Constant	2.027	0.624		3.248	0.023

DISCUSSION

The role of detection of bacterial antigen in CSF has been evaluated in this study for the diagnosis of childhood meningitis. In the present study, a total 40 study subjects meningitis the mean±sd found from the age (months) of our study was 29±10 years in bacterial, 23±7 in viral, 59±13 in tubercular and 51±13 in control group. A higher prevalence of meningitis was seen in the male patients in bacterial 12(30%) viral 11(27.5%) as well as female subjects 7(17.5%) found in both bacterial and tubercular. 4(10%) female found in viral and lowest 2(5%) male found in tubercular. 5(12.5%) both male and female found in control group. Neek rigidity and Kernig's sing was found positive 16 study subjects in bacterial, 11 in viral, 5 in tubercular and 3 in control group in both variable.Majority 19(47.5%) of the patients were having bacterial meningitis which was also observed in the early age group of childhood meningitis in another study in Bangladesh [15]. Respiratory tract infection (RTI) was found to be more common in the bacterial meningitis group (68.4%), followed by tubercular (50%) and viral group (40%) in the present study. This may be due to the fact that following a respiratory infection some organisms persist in the body and at some stage cause meningitis [16]. Out of 6 cases of tubercular meningitis only one had the history of BCG vaccination. Lack of BCG vaccination may be considered as a risk factor for the tubercular meningitis [17]. Family history of tuberculosis was found in one third 2(33.3%) of the children with tubercular meningitis. So, family history of tuberculosis and history of BCG vaccination should always be noted during the clinical diagnosis of tubercular meningitis in children. In all the groups of children with meningitis, an altered appearance such as ill looking, imtable response, vacant state, drowsiness or unconsciousness was the common features. However, both altered appearance and fever were of little importance in distinguishing the underlying cause of meningitis. Moreover, antibiotic therapy was started beforehand in many cases, so clinical symptoms were indistinguishable among different patient groups. In this study, skin rash was an infrequent finding in bacterial and viral meningitis but it was absent in tubercular group. Similar was the observation in other study [18]. Otitis media was found a substantial number of children (5/19, 26.3%) of bacterial meningitis but not in other groups. In a recent study otitis media has been identified as one of the predisposing factors for acute bacterial meningitis [19]. Although convulsion was a common feature in all the meningitis patients it was also found in the non meningitis control subjects. So, convulsion was not considered as a distinguishing clinical feature in diagnosis of different types of childhood meningitis. Signs of meningial irritation specially neck rigidity and Kernig's sign were more common in all meningitis groups compared to the control group which is also in agreement with the observation of others [20]. In this study, lymphadenopathy was commonest (83.3%) in the patients of tubercular meningitis and only in one case (5.3%) of bacterial meningitis but none of the viral group. However, other signs like general health, anaemia, palpable

spleen or liver. pulse, blood pressure and temperature of the studied children showed no significant difference (p = NS for all).In assessing the haematological findings, haemoglobin level and total count were not found to vary significantly between meningitis and non meningitis as well as among the different groups of meningitis. Although differential count of lymphocytes was more among the patients of tubercular meningitis than to viral or bacterial meningitis (46% vs. 38 % or 26%), did it not vary between meningitis and non meningitis control subjects. However, differential counts of polymorphs, esonophil, basophil and monocyte did not have any significant variation between meningitis and non meningitis as well as among different groups of meningitis patients. It was found that ESR was high both in meningitis and non meningitis control subjects. ESR level was significantly higher in bacterial and tubercular meningitis compared to viral meningitis or non meningitis patients and in tubercular meningitis ESR level was highest. In biochemical analysis of CSF, mean glucose level was found 44 ± 17 mg/dl in bacterial, 49 ± 9 mg/dl in tubercular and 52 ± 10 mg/dl in viral meningitis. A similar study by Converse et al., has also shown that glucose level in CSF was less than 45 mg/dl in pyogenic meningitis and 45 mg/dl or more in aseptic meningitis [21] CSF protein concentration was found to be significantly higher in bacterial meningitis compared to tubercular or viral meningitis. Raised protein concentration is due to increased permeability of blood brain barrier and also due to loss of albumin rich fluid from capillaries traversing the subdural space [16]. Predominant cell type in CSF of tubercular meningitis patient was lymphocytes. Whereas in bacterial meningitis both polymorphs and a mixed type (polymorphs and lymphocytes) and in viral meningitis, lymphocytes and mixed type of predominant cells were found. These are also in agreement with the common findings in different type of meningitis [1]. Test of bacterial antigen was found positive in most cases 14(73.6%) of bacterial meningitis but microscopy after gram staining was found positive in only 6 cases (31.5%) and culture in 6 cases (31.5%). No false positive bacterial antigen was found in CSF from tubercular, viral or the control groups. Thus, test for bacterial antigen could easily separate tubercular and viral from the bacterial meningitis group. Among these positive cases, bacterial antigen was highest for H. influenzae (42.1%) followed by S. pneumoniae (21.1%), N. meningitidis group-A / E coli (5.3%) and N meningitidis group-C(5.3%). It is worth mentioning that H. influenzae is the commonest causative organism of bacterial meningitis in the developing countries [22, 4]. In serum, bacterial antigen may give false positive results [16, 23]. For example, bacterial antigen and CRP continue to circulate in blood and CSF even after early instillation of antibiotic in meningitis [22, 24].

Limitations of the study

Our study wasn't a blinded study so patient bias was present along with observer bias in subjective recording and this was a single centered study with small sized samples. So, the findings of this study may not reflect the exact scenario of the whole country. Further study is required to have better understanding.

CONCLUSION

Dermination of the detection of bacterial antigen in CSF were studied in 40 cases of childhood meningitis to evaluate their diagnostic potential. Test of bacterial antigen was found positive in most cases of bacterial meningitis.Detection of bacterial antigen in CSF sample showed no false positive results in tubercular or viral meningitis. A majority of the CSF samples of bacterial meningitis was found to be positive for bacterial antigen even in the absence of positive culture. Although test for bacterial antigen in distinguishing bacterial meningitis from the other meningitis groups.It was found that other biochemical and cytological analysis of CSF sample were necessary for establishing the final diagnosis regarding the underlying cause. These findings suggest that bacterial antigen in CSF has got important value in early detection and management of meningitis in childrenand their appropriate management.

REFERENCE

1. Cull, R. E., & Will, R. G. (1995). Diseases of the nervous system. In: Davidson's Principal and Practice of Medicine 17th edn. Churchill Livingstone, Edinburgh, 1088-1095.
2. Singh, N., Arora, S., & Kahlon, P. S. (1995). Cerebrospinal fluid C-reactive protein in meningitis. Indian Pediatr, 32(6), 687-688.
3. Fasola, E., & Ferrieri, P. (1992). Laboratory diagnostic methods for central nervous system infections. Neurosurgery clinics of North America, 3(2), 279-290.
4. Werner, V., & Kruger, R. L. (1991). Value of the bacterial antigen test in the absence of CSF fluid leukocytosis. Laboratory Medicine, 22(11), 787-789.
5. Landgraf, I. M., Alkmin, M. D. G. A., & Vieira, M. D. F. P. (1995). Bacterial antigen detection in cerebrospinal fluid by the latex agglutination

test. Revista do Instituto de Medicina Tropical de São Paulo, 37(3), 257-260.
6. Rothrock, S. G., Green, S. M., Wren, J., Letai, D., Daniel-Underwood, L., & Pillar, E. (1992). Pediatric bacterial meningitis: is prior antibiotic therapy associated with an altered clinical presentation?. Annals of emergency medicine, 21(2), 146-152.
7. Dirks-Go, S. I., & Zanen, H. C. (1978). Latex agglutination, counterimmunoelectrophoresis, and protein A co-agglutination in diagnosis of bacterial meningitis. Journal of Clinical Pathology, 31(12), 1167-1171.
8. Whitby, M. I. C. H. A. E. L., Kristinsson, K. G., & Brown, M. O. R. A. G. (1985). Assessment of rapid methods of pneumococcal antigen detection in routine sputum bacteriology. Journal of clinical pathology, 38(3), 341-344.
9. Grasso, R. J., West, L. A., Holbrook, N. J., Halkias, D. G., Paradise, L. J., & Friedman, H. (1981). Increased sensitivity of a new coagglutination test for rapid identification of Haemophilus influenzae type b. Journal of clinical microbiology, 13(6), 1122-1124.
10. Denis, F., Samb, A., & Chiron, J. P. (1977). Bacterial meningitis diagnosis by counterimmunoelectrophoresis. JAMA, 238(12), 1248-1249.
11. Colding, H. A. N. N. E., & Lind, I. N. G. A. (1977). Counterimmunoelectrophoresis in the diagnosis of bacterial meningitis. Journal of clinical microbiology, 5(4), 405-409.
12. Severin, W. P. J. (1972). Latex agglutination in the diagnosis of meningococcal meningitis. Journal of Clinical Pathology, 25(12), 1079-1082.
13. Kiska, D. L., Jones, M. C., Mangum, M. E., Orkiszewski, D., & Gilligan, P. H. (1995). Quality assurance study of bacterial antigen testing of cerebrospinal fluid. Journal of clinical microbiology, 33(5), 1141-1144.
14. Deivanayagam, N., Ashok, T. P., Nedunchelian, K., Ahamed, S. S., & Mala, N. (1993). Evaluation of CSF variables as a diagnostic test for bacterial meningitis. Journal of tropical pediatrics, 39(5), 284-287.
15. Moinuddin, G., Mannan, M. A., Rob, M., & Rahman, H. (1994). Outcome of bacterial meningitis in children. Bangladesh J Child health, 18(3), 93-95.
16. Feigin, R. D. (1992). Infectious disease. In: Nelson text book of pediatrics Behrman, R. E., Vaughan, V. C., & Nelson, W. E., eds. 4th edn. Philadelphia Saunders, 658-691.
17. Korol, O. I., Odintsov, A. I., & Krivokhizh, V. N. (1994). Clinical course of tuberculosis in young children, vaccinated and non-vaccinated with BCG vaccine. Problemy tuberkuleza, (6), 21-24.
18. Muzzio de Califano, G., Alarcón, N., Rial, M. J., Szefner, M., & Palacio, E. (1997). Meningococcal meningitis: descriptive study of 76 cases in a pediatric hospital. Enfermedades infecciosas y microbiologia clinica, 15(9), 451-455.
19. Richardson, M. P., Reid, A., Williamson, T. J., Tarlow, M. J., & Rudd, P. T. (1997). Acute otitis media and otitis media with effusion in children with bacterial meningitis. The Journal of Laryngology & Otology, 111(10), 913-916.
20. Elmore, J. G., Horwitz, R. I., & Quagliarello, V. J. (1996). Acute meningitis with a negative Gram's stain: clinical and management outcomes in 171 episodes. The American journal of medicine, 100(1), 78-84.
21. Converse, G. M., Gwaltney Jr, J. M., Strassburg, D. A., & Hendley, J. O. (1973). Alteration of cerebrospinal fluid findings by partial treatment of bacterial meningitis. The Journal of pediatrics, 83(2), 220-225.
22. Surinder, K., Bineeta, K., & Megha, M. (2007). Latex particle agglutination test as an adjunct to the diagnosis of bacterial meningitis. Indian journal of medical microbiology, 25(4), 395-397.
23. Doskeland, S. O., & Berdal, B. P. (1980). Bacterial antigen detection in body fluids: methods for rapid antigen concentration and reduction of nonspecific reactions. Journal of Clinical Microbiology, 11(4), 380-384.
24. Sanborn, W. R., & Touré, I. M. (1984). A simple kit system for rapid diagnosis of cerebrospinal meningitis in rural areas of developing countries. Bulletin of the World Health Organization, 62(2), 293-297.