

Original Article

Common Cause and Cerebrospinal Fluid Changes of Acute Bacterial Meningitis

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ABSTRACT

Background and Objective: Bacterial meningitis is an important cause of mortality and long-term neural morbidity. Immediate diagnosis and treatment are necessary in appropriate time. This study was designed in Afzalipour Hospital in Kerman to evaluate meningitis causes, frequency and CSF laboratory changes.

Patients and Methods: In this retrograde descriptive study from September 2003 to September 2005, documents of all the hospitalized patients with diagnosed meningitis in Afzalipour Hospital of Kerman, southeast of Iran were studied.

Results: During this period, 126 patients were hospitalized. The age average was 15.2 ± 5.2 yr. Males were more than females (69% vs 31%) & 64% were children. Majority of patients were admitted in winter (42.9%) followed by spring (31%). 9.5% had viral meningitis. 89.5% of patients with bacterial meningitis had negative CSF culture. Positive culture included 6 cases of *H.influenzae* type B, 3 cases of pneumococcal and 3 cases of meningococcal. Average level of glucose in CSF in positive culture group was less than negative culture group (22.5mg/dl vs 53.5mg/dl). All positive culture patients had $\text{pro} > 100\text{mg/dl}$ and $\text{WBC} > 1000/\text{mm}^3$.

Conclusion: 10.5% of patients had positive culture, which might suggest that there were some errors in microbial cultures done in this hospital. More prevalence of meningitis in children was similar to other studies. The most common cause was *H.influenzae*, so Iranian children vaccination should be considered.

Keywords: Bacterial Meningitis, Cerebrospinal Fluid, Iran

Introduction

Meningitis is the inflammation of leptomeninges, which is shown by the abnormal increase of WBC (white blood cell) in CSF (cerebrospinal

fluid). The clinical manifestations are fever, headache and symptoms of meningeal irritation such as neck stiffness (1). Bacterial meningitis is a serious threat to global health accounting for an estimate 171000 deaths worldwide per year (2). Because of the high

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mortality rate of this disease and its irreversible but preventable complications with early treatment, early diagnosis and treatment is vital. CSF analysis has a critical role in diagnosis. It is essential to have correct differential diagnosis between bacterial and viral causes before starting antibiotic therapy, therefore research on the distinguishing factors would lead to administration of antibiotics when needed and prevention of imposing drug side effects when there is no necessity (1,3). When meningitis is suspected, lumbar puncture should be performed within 8 hours of initiating IV antibiotic to prevent missed diagnosis due to early CSF sterilization (4). CSF analysis Because of the importance of this disease requires intermittent studies for identification of the causes.

The statistics and data that develop the principal of treatment and approach to a patient with meningitis are often the result of investigation in developed countries and regarding the fact that the immunization programs of those countries are different (example: immunization against *Hemophilus influenza* in America and Europe) and pathogens vary depending on the different geographical locations and environmental circumstances (1,3,5,6), it is necessary to have local researches on this field.

The aim of study is etiology of acute meningitis and cerebrospinal fluid Findings in patients . According to these studies, immunization can be planned against the common causes of meningitis.

Material and Methods

This descriptive retrospective study was carried out on the patients with acute meningitis admitted in the Pediatric , Internal and Infectious wards of Afzalipour Hospital, Kerman Southeast Iran, during 2003-2005. The information was extracted from their hospital documents. Then the data were analyzed using SPSS program.

Table 1: Mean WBC count, glucose and protein concentration in CSF in 2 groups of positive and negative CSF culture in patients with acute meningitis in Afzalipour Hospital of Kerman City from December 2003- December 2005.

	culture	N	Mean
RBC count/mm³	negative	108	1358.75
	positive	12	260
WBC count/mm³	negative	114	899.34
	positive	12	2632.5
Glucose of CSF mg%	negative	114	55.36
	positive	12	22.5
Protein of CSF mg%	negative	114	117.26
	positive	12	315.5

Results

One hundred twenty six patients were admitted during the research, 69% male and 31% female , the difference was significant ($P<0.05$) . Their average age was 15.2 ± 5.2 years. 64.3% (n=81) of the patients were in children and adolescent group and 35.7% (n=45) were adults. The youngest patient was one month and oldest patient was 74 years old. Twenty one percent of patients were <1 year, 16.6% 1- 5, 26.2% 6-14, 31% 15-60 and 4.8% > 60 years.

In under 1 years old most of the cases were female (67% vs. 33%) but in other age group dominancy was with males (78% vs. 21.2%). Comparing two groups, 86.7% of adults were male, but in the other group (under 15 years old) this ratio was equal (59% male, 41% female) ($P<0.05$).

42.8% of the patients were admitted in winter, 31% in spring , 16.7% in summer and 9.5% in autumn.

According to the clinical presentations and course and the criteria of CSF analysis in 126 patients, (12 cases) 9.5% were admitted with the diagnosis of viral meningitis . From 114 bacterial cases, 102 had a negative CSF smear and culture (89.5%) and 12 had a positive CSF smear and culture (10.5%) with 6 cases of *H. influenza* b, 3 cases of *Pneumococcus* and 3 cases of *Meningococcus* reported from microbiological studies. Reported cases of *Pneumococcus* and *H. influenza* type b were from the pediatric ward and cases of *Meningococcus* from the infectious ward.

The average age in positive culture group was 5.4 years in comparison with 16.2 years in the negative culture group ($P<0.05$) .

Mean CSF glucose level in the positive culture group was 22.5 mg/dl which was lower than the 53.3 mg/dl of the culture negative group. This difference was significant ($P<0.01$) (Table 1 and 2).

Table 2: CSF glucose concentration in positive and negative CSF culture in patients with acute meningitis in Afzalipour Hospital of Kerman City from December 2003-2005

Culture		Glucose range			Total
		<20	20-25	>50	
Negative	Count	24	27	63	114
	% within culture	0.211	0.237	0.553	1
Positive	Count	6	6		12
	% within culture	0.5	0.5		1
Total	Count	30	33	63	126
	% within culture	0.238	0.262	0.5	1

Mean CSF protein level in the positive culture group was 315 mg/dl which was more than the 117 mg/dl of the culture negative group. All the culture positive patients had a protein level more than , 100 while 57.9% of the culture negative cases had a protein level under) 45 $P<0.05$) (Table 3).

Table 3: CSF protein concentration in positive and negative CSF culture in patients with acute meningitis in Afzalipour Hospital of Kerman City from December 2003-2005

Culture		Protein			Total
		<45	45-100	>100	
Negative	Count	66.00	24.00	24.00	114
	%	57.90	21.05	21.05	100.00%
Positive	Count			12.00	12
	%			100.00	100.00%
Total	Count	66.00	24.00	36.00	126
	%	52.40	19.00	28.60	100.00%

Average WBC count in positive and negative culture groups were respectively/2635 cc and/899 cc. Overall ,most of the patients had 100-500 WBC in their CSF but in the culture positive group 50% had 1000-10000 WBC) $P<0.05$). There were only 3

cases with WBC more than 10000 and all of them were in the culture positive group. In 64% of the case PMN (polymorphonuclear cell) was dominant in CSF ($P<0.0001$) (Table 4) .

Table 4: CSF WBC count in positive and negative CSF culture in patients with acute meningitis in Afzalipour Hospital of Kerman City from December 2003-2005

Culture		WBC							Total
		<5	5-45	46-100	101-500	501-1000	1001-10000	>10000	
Negative	Count	27.0	12.0	18.0	36.0	9.0	9.0	3.0	114
	%	23.7	11.0	15.8	31.6	7.9	7.9	2.6	100.00%
Positive	Count		3.0		3.0		6.0		12
	%		25.0		25.0		50.0		100.00%
Total	Count	27.0	15.0	18.0	39.0	9.0	15.0	3.0	126
	%	21.4	12.0	14.3	31.0	7.1	11.9	2.4	100.00%

In 66.65% CSF was colorless. In 50% with a CSF positive culture the appearance of CSF was milky.

(Table 5). Seventy five percent had a history of taking antibiotics before admission in hospital .

Table 5: CSF color changes in positive and negative CSF culture in patients with acute meningitis in Afzalipour Hospital of Kerman City from December 2003-2005

Culture		Color of CSF				Total
		Colorless	Yellow	Milky	Bloody	
Negative	Count	78.0	15.0	15.0	6.0	114
	%	68.4	13.2	13.2	5.2	100.00%
Positive	Count	6.0		6.0		12
	%	50.0		50.0		100.00%
Total	Count	84.0	15.0	28.0	6.0	126
	%	66.65	11.95	16.65	4.75	100.00%

Discussion

Higher prevalence of meningitis in male, which was shown in this research, was also indicated in previous studies; also higher prevalence of meningitis in children and adolescents is approved in other studies (3,5,7,8). However in this research the number of adults was abnormally high(35.7%), which epidemiologic discussion on this issue is not possible due to the fact that this study consisted of referral cases which were not sampled .The increase of the prevalence of meningitis in female in the age group under one year was recognizable. Another important finding of this study was the high prevalence in winter specially February and March which had 42.8% of all cases admitted during the year this finding was significant. Higher prevalence in March and lower prevalence in August in our study was the same as the other study (3).

The rate of bacterial meningitis in previous studies with positive smear and culture was between 20-50% of all cases (7;9-11), whereas in this study only 10.5% of cases with meningitis symptoms and CSF changes approving meningitis had a positive smear or culture. This can be due to the inappropriate condition of hospitals microbiologic laboratory, also because of the previous antibiotic therapy the patients had taken before admission(75% of the cases). Anyhow, the above fact mentions that smear and culture cannot be a method for early and precise diagnosis of meningitis, detection of the cause or a base for starting or even continuing the treatment .The low rate of positive culture in this hospital makes serious attention on this field necessary.

H. influenza type b was the most common pathogen in the positive culture group which was consistent with the previous studies (3,12-14). Regarding the fact that vaccination against *H. influenza* type b is not routine in Iran this was predictable. *Pneumococcus* was more prevalent in another study, which may be because of local factor influence (10).

Streptococcus species have been the major case of bacterial meningitis in many country (8).Vaccination against Hib resulted in impressive reductions in disease and reduced the carriage of the bacteria among vaccinated and non-vaccinated individuals. In the USA, with the advent of the Hib conjugate vaccine, Hib cases in children under 5 years of age declined by 99% from 1986 to 1995; this decline has also occurred in other resource-rich countries. This beneficial shift in epidemiology of BM prompted the WHO to recommend that the Hib vaccine should be included in routine infant immunization programs for all children, as appropriate to national capacities and priorities (15).

InTurkish children, *Neisseria meningitis* was the most common of cause. This study highlights the emergence of serogroup W-135 diseases in Turkey and concludes that vaccine meningococcal in this region must provided reliable protection (16).

All the bacterial cases had an increased protein level in CSF which can help in differential diagnosis specially when the protein is more than 100 mg/dl. About the cellular changes of CSF in aseptic cases WBC counts were between 100-500/mm³, which was consistent with another study (17).

Despite the previous insistence on cellular dominancy, the primary LP can not be distinguished

because in 64% of the cases the dominance was with PMN, which reached up to 86% in negative culture cases, confirmed elsewhere (18) which suggested that when CSF results are vague, antibiotic therapy should be started regardless of cellular dominance, and LP must be repeated during the next days.

Even in the high prevalence season of aseptic meningitis positive predictive value for PMN dominance is much higher than of bacterial meningitis, so they recommended that despite of few days passing the onset of the disease and PMN dominance, still aseptic meningitis can be a diagnosis.

Conclusion

Regarding the limitations of microbial culture, latency of their results and the importance of early treatment, paying serious attention to CSF changes has an efficient role in meningitis diagnosis. In vague conditions antimicrobial treatment must be started and the patient should be followed in the next days.

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