

Biochemical Changes of Cerebrospinal Liquid in Viral Meningitis

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The aim of the study was to analyse the biochemical changes of CSF in acute viral meningitis, in correlation with age. The retrospective study included 90 cases of viral meningitis (57 males and 33 females), aged between 6 months and 37 years, admitted in the Clinical Hospital of Infectious Diseases Iasi between 1st of January and 31st of December 2012. The values of albumin, glucose and chloride were analysed in the CSF, depending on the age. The medium albumin level in the CSF was 0.71 g/L and it was raised in 64% of cases. High values were registered in the group 16-30 year old patients, and it was normal in the group 1-5 years old. The glucose level in CSF had a medium value of 0.59 g/L and it was raised in 78.89% of cases, regardless of the age. Chloride level in CSF had a medium value of 7.25 g/L and it was raised in 71.11 % of cases, regardless of the age. In viral meningitis, biochemical changes of CSF are minimum and independent of the age, excepted high levels of albumin in CSF in adults.

Keywords: CSF, viral meningitis, albumin level

Viral meningitis represents an important cause for hospital admission. The incidence reported is surely underestimated, especially in the case of entero-viral meningitis, the most frequent identified pathogen agents. The differentiation of viral meningitis from bacterial meningitis at hospital visit or admission, based on clinical picture and on initial test results of cerebrospinal liquid are a real challenge. There are considerable benefits if this discovery is made rapidly, from the point of view of diagnosis orientation, but especially therapeutic, with major impact upon vital and sequelae prognosis.

The aim of the study was represented by the analysis of LCR biochemical changes in acute viral meningitis in correlation with age group.

Experimental part

Materials and methods

The retrospective study included 90 cases of acute viral meningitis (57 males and 33 female), aged between 6 months and 37 years, hospitalized at Infectious Disease Clinic of Iasi during January 1st - December 31st 2012. Albuminorrachia, glycorrhachia and chlororrachia values were analyzed, depending on the age group.

In this paper, the instrument used for research was medical statistics, both descriptive and inferential, also

applying some statistical tests for assessing the statistic meaning (test Z and calculating p value).

Results and discussions

The incidence of viral meningitis had an ascending evolution with a maximum in 6-15 year old age group (59%), and a subsequent decrease up to the age of 40. Most of cases were recorded in children (75%) (fig.1).

In 2012, the viral meningitis influenced male patients in a percentage of 63.33% and female patients in a percentage of 36.67%.

In most cases, LCR aspect was clear, opalescent in 15.56% cases and hematic in 2.22% (fig.2):

Albumin, glucose and chloride quantity was analyzed at LCR biochemical test.

Albuminorrachia had values between 0.21 and 2.31, with an average value of 0.71 g/L. Albuminorrachia was raised in 57 cases and normal in 33 cases.

The statistic analysis showed that the infant patient had raised albuminorrhachia. In 1-5 years old - age group, albuminorrachia was high in a patient (7.69%) and low in 12 patients (92.31%). In 6-15 years old - age group, albuminorrachia was high in 34 de patients (64.15%) and normal in 19 patients (35.85%). In 16-20 years old and 21-30 years old - age groups, albuminorrachia was high in all ----- . In 31-40 years old - age group, albuminorrachia

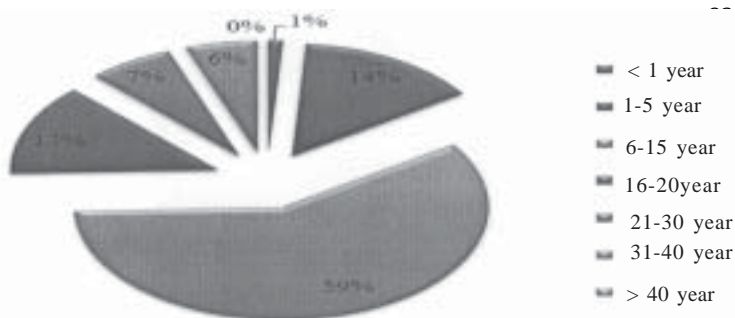


Fig. 1. Percentual distribution of viral meningitis cases on age groups



Fig. 2. LCR aspects in patients with viral meningitis

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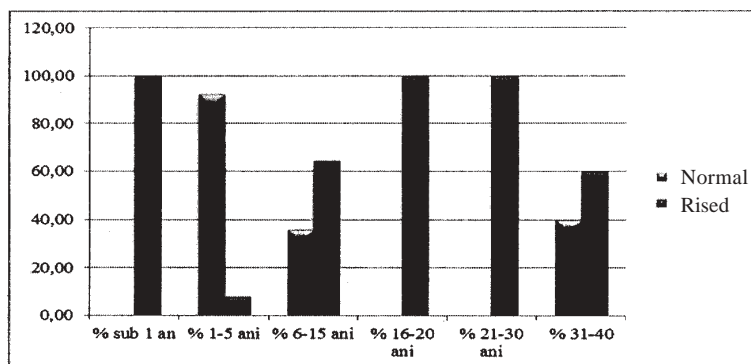


Fig. 3. Comparative analysis of albuminorrachia on age groups

Value of alb.	1-5 years old (%)	Rest of cases (%)	Z	P Value
Normal	12 (92%)	21 (27%)	6.8973	0
Raised	1 (8%)	56 (73%)	-7.6105	0
Total	13 (100%)	77 (100%)		

Table 1
COMPARATIVE ANALYSIS OF ALBUMINORRACHIA VALUES BETWEEN THE AGE GROUP OF 1-5 YEARS OLD AND THE REST OF THE CASES

Value of alb.	16-20 years old (%)	Rest of cases (%)	Z	P Value
Normal	0 (0%)	33 (42%)	-8.1933	0
Raised	12 (100%)	45 (58%)	6.9328	0
Total	12 (100%)	78 (100%)		

Table 2
COMPARATIVE ANALYSIS OF ALBUMINORRACHIA VALUES IN AGE GROUPS OF 16-20 YEARS OLD AND THE REST OF THE

Value of alb.	21-30 years old (%)	Rest of cases (%)	Z	P Value
Normal	0 (0%)	33 (39%)	-8.8245	0
Raised	6 (100%)	51 (61%)	5.9202	1,6293*e-9
Total	6 (100%)	84 (100%)		

Table 3
COMPARATIVE ANALYSIS OF ALBUMINORRACHIA VALUES IN AGE GROUPS OF 21-30 YEARS OLD AND THE REST OF THE CASES

was high in 3 patients (60%) and low in 2 patients (40%) (fig. 3).

At the age group of 1-5 years old, the patients had a higher likelihood to present a normal level of albuminorrachia ($p=0$), while in the rest of patients, the likelihood to present a raised level of albuminorrachia ($p=0$) was higher (table 1).

For the age groups of 6-15 years old and 31-40 years old there were no significant differences compared to the other age groups.

For the age groups of 16-20 years old and 21-30 years old, albuminorrachia was probably higher ($p=0$, respectively $p=1.62938^*$ tends towards 0), compared to the other groups where it is more probable that the level of albuminorrachia is normal ($p=0$) (table 2 and 3).

Table 4
GLYCORRHACHIA IN PATIENTS WITH VIRAL MENINGITIS

Level of glucose in LCR	No. of cases	%
Normal	15	16.67
Low	4	4.44
Raised	71	78.89
Total	90	100

Glycorrhachia was between 0.28 and 1.1 g/l, and the calculated average value was 0.59 g/L. Most of patients had a high level of glucose in LCR, 15 patients had normal glycorrhachia, and 4 patients had low glycorrhachia (table 4).

Compared to the age group of 1-5 years old, a higher likelihood of low glycorrhachia was noticed in the other age groups ($p=0.0004$) (table 5).

For the age group of 6-15 years old, there were no statistic significant differences compared to the other age groups.

Compared to the age groups of 16-20 years old and 31-40 years old, a higher likelihood to have a low level of glycorrhachia was noticed in the other age groups ($p=0.0002$, respectively $p=0$) (table 6 and 7).

Instead, compared to the age group of 21-30 years old, the likelihood to have a raised level of glycorrhachia was higher in the rest of the groups ($p=0.03$) (table 8).

The last element studied in the biochemical exam of LCR was the level of chlorurorrachia. The resulted data showed that the values of chlorurorrachia were between 6.12 and 7.7 g/l, and the average value was 7.25 g/L. Most patients (71.11%) had hyperchlorurorrachia, 26.67% had a normal level and only 2.22% had hypochlorurorrachia.

Val glic.	1-5 years old (%)	Rest of cases (%)	Z	P Value
Normal	2 (15%)	13 (17%)	-0.4265	0.33
Raised	11 (85%)	60 (78%)	0.3175	0.37
Low	0 (0%)	4 (5%)	-3.3181	0.0004
Total	13 (100%)	77 (100%)		

Table 5
COMPARATIVE ANALYSIS OF GLYCORRHACHIA BETWEEN THE AGE GROUP OF 1-5 YEARS OLD AND THE REST OF PATIENTS

Val. Glic	16-20 years old (%)	Rest of cases (%)	Z	P Value
Normal	2 (17%)	13 (17%)	-0.3050	0.38
Raised	10 (83%)	61 (78%)	0.1366	0.44
Low	0 (0%)	4 (5%)	-3.4650	0.0002
Total	12 (100%)	78 (100%)		

Table 6
COMPARATIVE ANALYSIS OF GLYCORRHACHIA BETWEEN THE AGE GROUP OF 16-20 YEARS OLD AND THE REST OF THE PATIENTS

Val. Glic	31-40 years old (%)	Rest of cases (%)	Z	P Value
Normal	1 (20%)	14 (16%)	-0.3208	0.37
Raised	4 (80%)	67 (79%)	-0.4468	0.32
Low	0 (0%)	4 (5%)	-6.1463	0
Total	5 (100%)	85 (100%)		

Val. Glic	21-30 years old (%)	Rest of cases (%)	Z	P Value
Normal	2 (33%)	13 (15%)	0.3940	0.34
Raised	3 (50%)	68 (81%)	-1.7725	0.03
Low	1 (17%)	3 (4%)	0.3490	0.36
Total	6 (100%)	84 (100%)		

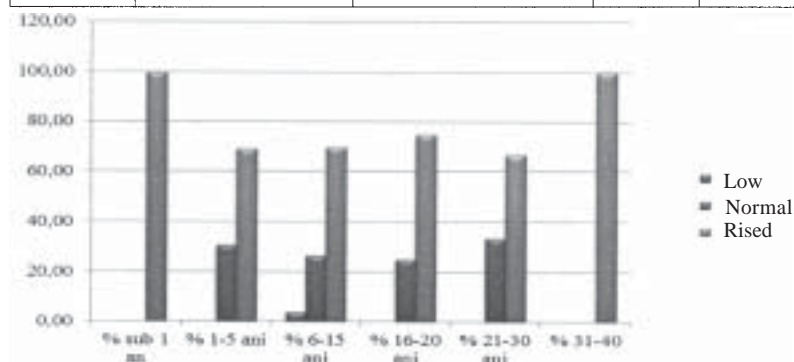


Fig. 4 Comparative analysis of chlorurorrhachia on age groups

Chlorurorrhachia	1-5 years old (%)	Rest of cases (%)	Z	P Value
Normal	0 (0%)	19 (25%)	-5.6751	6.96*
Raised	4 (31%)	56 (72%)	-3.2477	0.0005
Low	9 (69%)	2 (3%)	4.9034	4.71*
Total	13 (100%)	77 (100%)		

Chlorurorrhachia	16-20 years old (%)	Rest of cases (%)	Z	P Value
Normal	3 (25%)	20 (26%)	-0.3336	0.36
Raised	9 (75%)	55 (71%)	0.0040	0.49
Low	0 (0%)	2 (3%)	-3.3733	0.00009
Total	12 (100%)	77 (100%)		

Chlorurorrhachia	21-30 years old (%)	Rest of cases (%)	Z	P Value
Normal	2 (33%)	21 (25%)	0.0300	0.48
Raised	4 (67%)	61 (73%)	-0.6896	0.24
Low	0 (0%)	2 (2%)	-6.0832	0
Total	6(100%)	84 (100%)		

Value of chlor.	31-40 years old (%)	Rest of cases (%)	z	P Value
Normal	0 (0.00%)	23 (27.71%)	-7.5535	0
Raised	5 (100.00%)	60 (72.29%)	3.7277	0.00009
Total	5 (100.00%)	83 (100.00%)		

The cases with a raised level of chlorurorrhachia prevailed in all age groups (in a percentage that varied between 67-100%) (fig. 4).

Compared to the age group of 1-5 years old, the rest of the patients had a higher likelihood of raised chlorurorrhachia ($p=0.0005$). Instead, the age group of 1-5 years old has a higher likelihood of hypochlorurorrhachia ($p=4.71^*$) - (table 9)

Statistically speaking, there were no significant differences between the age group of 6-15 years old and the other age groups.

Compared to the age groups of 16-20 years old and 21-30 years old, the rest of the patients had a higher likelihood for low chlorurorrhachia ($p=0.00009$, respectively $p=0$) (table 10 and 11)

Table 7
COMPARATIVE ANALYSIS OF GLYCORRHACHIA BETWEEN THE AGE GROUP OF 31-40 YEARS OLD AND THE REST OF PATIENTS

Table 8
COMPARATIVE ANALYSIS OF GLYCORRHACHIA BETWEEN THE AGE GROUP OF 21-30 YEARS OLD AND THE REST OF PATIENTS

Table 9
COMPARATIVE ANALYSIS OF CHLORURORRACHIA BETWEEN THE AGE GROUP OF 1-5 YEARS OLD AND THE REST OF CASES OF VIRAL MENINGITIS

Table 10
COMPARATIVE ANALYSIS OF CHLORURORRACHIA BETWEEN THE AGE GROUP OF 16-20 YEARS OLD AND THE REST OF VIRAL MENINGITIS CASES

Table 11
COMPARATIVE ANALYSIS OF CHLORURORRACHIA BETWEEN THE AGE GROUP OF 21-30 YEARS OLD AND THE REST OF VIRAL MENINGITIS CASES

Table 12
COMPARATIVE ANALYSIS OF CHLORURORRACHIA BETWEEN THE AGE GROUP OF 31-40 YEARS OLD AND THE REST OF VIRAL MENINGITIS CASES

In the age group of 31-40 years old there was a higher likelihood of hyper chlorurorrhachia ($p=0.00009$), and in the rest of the patients, of normochlorurorrhachia ($p=0$), (table 12).

The macroscopic analysis of LCR sampled from patients with viral meningitis showed that in 82.22% of cases, its aspect was clear, and in 15.56% of cases, it was opalescent, data resembling to those from specialty literature where the clear or opalescent aspect is considered typical for viral meningitis. In the two cases where the aspect was hematic, this may also be due to the lumbar puncture.

Albuminorrhachia had an average value of 0.71 g/L, and 35.96% had a normal value (between 0.2-0.5 g/L), which means a moderate increase of albuminorrhachia, data

comparable to those mentioned in the specialty literature. The study of albuminorrachia on age groups showed that in the age group of 1-5 years old, it is more probable that the patients have a normal value of albuminorrachia ($p=0$), in the age group of 6-15 years old there were no significant differences compared to the other patients, in the age groups of 16-20 years old ($p=0$) and 21-30 years old ($p=1.6293^*$) is more probable that patients have a raised value of albuminorrachia; there were no significant differences for the age group of 31 - 40 years old.

Glycorrachia of patients with viral meningitis had an average value of 0.59 g/L, and 78.89% of patients had raised glycorrachia, different results compared to those presented in the specialty literature, where glycorrachia of patients with viral meningitis is almost always normal. Cases of raised glycorrachia prevailed in each age group. In the age group of 1-5 years old there is a higher likelihood of having low glycorrachia ($p=0.0004$) compared to the other groups.

Chlorurorrachia of patients with viral meningitis had an average value of 7.25 g/L, value slightly raised compared to the superior edge of the normal limit (7.20 g/L). In this paper, in 71.11% of the cases, chlorurorrachia was raised, in the specialty literature cvasinormal chlorurorrachia is mentioned in patients with viral meningitis. The study of chlorurorrachia on age groups showed for the age group of 1-5 years old a higher likelihood of having a low level, compared to the other age groups ($p=4.71$) and the age group of 31-40 a higher likelihood of having a low level of chlorurorrachia ($p=0.00009$).

Conclusions

In our study, the chemical changes of LCR were minimal and independent of age, except hyperalbuminorrachia in adults. The analysis of these changes allows a first etiologic orientation and facilitates the institution of an adequate therapy.

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