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TOTAL LIPIDS AND LIPOPROTEINS OF THE
CEREBROSPINAL FLUID IN MENINGITIS

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Even though various researchers have interested themselves in the subject, the results obtained have not concurred because of the difficulties that the analytical method entails and because of the variety of techniques that were employed.

M. Farstad, studying the lipids contained in the cerebrospinal fluid of patients with a disease of a psychiatric nature, encountered values on the order of 2.83 milligram percent, of which cholesterol accounted for 40 percent.

Tourtelotte et al. (1962), applying the bichromate oxidation quenching method, found values fluctuating around 1.25 milligram percent.

Roboz et al., applying the same technique, obtained values on the order of 2.5 milligram percent.

McArdle and Zilkla especially busied themselves in investigating phospholipids through chromatography on paper in patients afflicted with suppurative, tuberculous, and viral meningitis, cerebrospinal fluid hypertension, and cerebral abscesses; the phospholipid content, from the qualitative standpoint, did not especially differ from that of normal subjects.

The existence of lipoprotein complexes was subsequently demonstrated in cerebrospinal fluid at the time of the initial experiments of the electrophoretic separation of cerebrospinal

fluid protein.

Boudouin (1953 and 1955) et al. were able to evidence bands that they compared with those of serum. Since that time, there has predominated the notion that, while lipoproteins in serum are arranged in 2 bands corresponding to alpha globulin and beta globulin, only the alpha-globulin fraction is observed in cerebrospinal fluid. These researchers nevertheless encountered the appearance of lipoprotein during various types of meningitis.

Dencker and Swahn (1961), moreover, emphasized how the appearance of beta lipoprotein occurs only during serious diseases of the nervous system, like tumors and various kinds of meningitis.

The foregoing enables us to deduce how an analysis of the total quantity of lipid and lipoprotein in cerebrospinal fluid may represent, even if it does not make a decisive diagnostic contribution, an ever-useful element in the study of the evolution of clinical pictures and of the pathogenesis of nervous system diseases in general and of the inflammatory processes connected with this system in particular. For this reason we, too, undertook the task of investigating the behavior of lipids and lipoproteins in meningitis subjects, as well as of further considering the problem.

Material and Method

The cerebrospinal fluid was obtained through a lumbar puncture from subjects with acute and chronic meningitis in university and hospital departments.

In the cerebrospinal fluid we determined:

a) total lipid content in accordance with La Hueriga's method, with extraction effected under heat with an alcohol-ether mixture and with the solution in ethylene-dioxide and precipitation effected with sulfuric acid. The analytical process was carried out in the following phases:

1) 4.5 cubic centimeters of the alcohol-ether mixture were poured into a centrifuge test tube, subsequently 0.5 cubic centimeter of cerebrospinal fluid is added drop by drop and stirred: stirring is effected energetically for several seconds.

2) The test tube is placed in bain-marie at a temperature ranging from 50-60 degrees and kept therein for 30 minutes,

it is then cooled in water and increased to a volume of 5 cubic centimeters with the alcohol-ether mixture; it is then stirred and centrifugalized.

3) One cubic centimeter of the centrifugalized material is then poured into a test tube, some grains of carborundum are added; it is then placed, dry, in a boiling bain-marie.

4) Two cubic centimeters of ethylene-dioxide are added to the test tube; it is again placed in a boiling bain-marie and then cooled.

5) Six cubic centimeters of sulfuric acid are added; it is stirred and then allowed to rest for 30 minutes. Subsequently it is stirred again.

6) The instrument is made blue with H₂O by using a blue filter (490 millimicrons); the extinction of the sample under consideration is read and the sample is then raised to a milligram of lipids for 100 cubic centimeters via a calibration curve.

b) Lipoproteins: the cerebrospinal fluid was centrifugalized in advance at a rate of 3,000 revolutions a minute; then 0.05 milliliter was extracted with a capillary pipette and deposited on paper.

1) The strips were soaked beforehand with an ph 8.6 barbituric pad solution.

2) The migration occurred in a humid room at 360 volts for 3 hours.

3) The strips were then colored with 7B red diluted with distilled water.

4) The strips were read photocolormetrically, prior to elution (eluizione), with a 550-millimicron filter.

Results (see Table)

Total Lipoproteins and Lipids			
Patients and diagnoses	Lipoprotein		Total lipids, % mg.
	1st Fract.	2d Fract.	
G.M. Acute meningococcic suppurative meningitis	64.9	35.1	125
D.M. Acute meningococcic suppurative meningitis	57.5	42.5	65
S.A. Acute meningococcic suppurative meningitis	63.8	36.2	37.5
A.D. Acute meningococcic suppurative meningitis	56.1	43.1	90
R.P. Acute suppurative meningitis of b. coli	61.6	38.4	125
T.S. Abscess meningitis during pharyngotonsillitis	57	43	37.5
D.V. Abscess meningitis during pharyngotonsillitis	57.2	42.8	65
D.M. Abscess meningitis during epidemic parotiditis	59	41	105
D.V. Abscess meningitis during pharyngotonsillitis	60	40	87
S.S. Chronic tuberculous meningitis	57.5	42.5	135
A.M. Chronic hydrocephalus	59	41	87

In a subject who has no nervous system disease, the total lipids in cerebrospinal fluid is, according to our method, 28.2 percent; from the same subject we obtained the electrophoretic separation of 2 lipoprotein bands. The first band, with more rapid migration, has a value of 52.1, the second band 47.9.

In the meningitis subjects the values of the total lipids found by us ranged from 37.5 milligram percent to 125 milligram percent. The lowest values encountered corresponded to the cerebrospinal fluid of patients with tuberculous and abscess meningitis. The highest -- 135 milligram percent -- was encountered in a case of tuberculous meningitis.

As to the lipoproteins, even here in all cases considered by us, it was possible to encounter 2 electrophoretic fractions: the first with maximum values of 64.9 percent (meningococcic suppurative meningitis) and with a minimum value of 57 percent (abscess meningitis during pharyngotonsillitis); the second with values fluctuating between 43.1 percent (in a case of meningococcic suppurative meningitis) and 35.1 percent (in a case with the same disease).

In a case of chronic hydrocephalus, lipids totaled 87 milligram percent, the more rapid fraction was 59 percent, and the second 41 percent.

Concluding Considerations

The results obtained by us in this investigation have enabled us to reveal the continuous presence of 2 cerebrospinal lipoprotein bands. The total lipids in our research exceed those encountered by the researchers who have previously studied this subject and exceed, even if moderately, those of the cerebrospinal fluid of subjects without nervous system diseases. Moving on to an examination of the data obtained in the various diseases considered, which include 4 cases of meningococcic suppurative meningitis, a case of suppurative meningitis by bacteria coli, 4 cases of abscess meningitis (of which 3 during pharyngotonsillitis and 1 during epidemic parotiditis), a case of chronic tuberculous meningitis, and a case of chronic hydrocephalous, we can state that the value obtained with respect to the total lipids are not reconcilable in groups determined in relation to the type of meningitis but have variations that are independent of the etiology itself.

As to the lipoproteins, the more rapid fraction had an almost continually higher proportion in the forms of suppurative meningitis, both of the meningococcic and the bacteria-coli variety, while the lower values were associated with abscess meningitis, with tuberculous meningitis, and with chronic hydrocephalous.

In conclusion we can say that total lipids increase in all the diseases taken into consideration, but in a way independent of the disease's ideology. Constant is the presence of the 2 lipoprotein bands, with higher values for the band with the slower migration for the various types of abscess meningitis, chronic tuberculous meningitis, and chronic hydrocephalous; while the more rapid band is percentually more represented in acute suppurative meningitis. While the variability of the data obtained does not enable us to draw definitive conclusions, it seems to us that the results we obtained may be of a certain pertinence and lead to further studies.

Summary

The researchers studied the behavior of all the lipoproteins and lipids in subjects with meningitis of various etiology, showing in the overall picture, even if there is a

certain variability of results, an increase in total lipids in the cerebrospinal fluid of the subjects examined and the continuous presence of 2 lipoprotein fractions with a variable proportional relationship.

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