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Effects of Chronic Hypoxia on Serum Lipids and Lipoproteins

Experiments in animals and humans have shown that chronic hypoxemia promotes a rise of free fatty-acids in plasma that has been attributed to a greater adrenergic activity (1). Changes have also been described in other lipidic fractions although there is no agreement in the findings of different authors (3, 4). The known differences in lipid metabolism among different animal species, and in their respect to humans, restrain the value of the experimental results when they are evaluated with comparative physiological criteria. Furthermore any progress in the understanding of lipids and their metabolism in human beings is highly interesting, considering the importance that dislipohemias have in the etiology of various cardiopathies and degenerative vascular diseases. As in previous works (9, 11), it has been considered convenient to take advantage of a series of chronic hypoxemia affected patients, to clarify in them possible changes in the lipid serum levels.

A sample of 36 individuals affected by respiratory insufficiency secondary to chronical obstructive pulmonary disease, was selected as described before (9, 11). Patients were classified in the following three groups: A) individuals affected by intense hypoxemia with arterial PO_2 below 6.66 KPa and a percentage of hemoglobin saturation with O_2 less than 80 %; B) individuals affected by medium hypoxemia with arterial PO_2 between 6.66 and 7.73 KPa and O_2 saturation between 80 and 90 %; and C) normoxemic individuals with no pathology, a PO_2 above 9.8 KPa and O_2 saturation equal to or above 95 %. Arterial blood samples were obtained by radial artery puncture under rigorous anaerobic conditions. Values of PO_2, PCO_2, pH and depending parameters, were determined and submitted to a quality control as previously described (11). The serum lipid determinations were realized by routine methods in the Clinical Laboratory of the Hospital. The statistical parameters for the analyzed samples were evaluated and compared through a variance analysis. Samples were classified here as pathological accepting PO_2 = 8 KPa as the limiting value between hipoxemia and normoxemia (2). The PCO_2 values showed that in all hypoxemic cases there was hypercapnia, without statistical differences in comparing both groups ($p > 0.05$). From the analyzed values of total CO_2, present CO_3H^- and base excess, it can be inferred that respiratory acidosis in those suffering from moderate hypoxemia was totally compensated, while those affected by intense hypoxemia had (H^+) exceeding physiological limits. These conditions imply that all physiological or physiopathological changes in moderate hypoxemia must be attributed mainly to the lack of oxygen or to the hypercapnia. In severe hypoxemia the possible effects of acidosis have also to be considered. At any rate the con-

Table I. *Lipidic parameters (mmol/l, mean ± SD) for intense hypoxemia (A), moderate hypoxemia (B) and normoxemia (C) groups.*
Signification of Student «t» test between groups: * $p < 0.05$, ** $p < 0.01$, n.s. = no significant.

Parameters	A (n = 12)	B (n = 24)	C (n = 15)	A-C	B-C	A-B
Triglycerides	1.554±0.577	1.415±0.503	1.150±0.944	n.s.	n.s.	n.s.
Phospholipids	2.749±0.498	2.820±0.414	2.928±0.353	n.s.	n.s.	n.s.
Total cholesterol	5.572±1.979	4.947±1.229	5.318±1.104	n.s.	n.s.	n.s.
Free cholesterol	1.550±0.793	1.385±0.356	1.320±0.242	n.s.	n.s.	n.s.
HDL cholesterol	1.143±0.339	0.981±0.325	1.829±0.910	*	**	n.s.
LDL cholesterol	2.737±2.042	3.301±1.268	2.804±1.387	n.s.	n.s.	n.s.
Total chol./HDL chol.	5.140±1.634	5.470±2.136	3.448±1.427	**	**	n.s.
FFA	0.611±0.335	0.573±0.283	0.355±0.085	*	*	n.s.
FFA/Albumin	0.992±0.416	1.063±0.532	0.616±0.133	**	**	n.s.

tinuous interdependence of these three factors always makes difficult to ascertain which of them is mainly responsible of any changes.

Seric concentrations of triglycerides and phospholipids (table I) were statistically analogous in all groups ($p > 0.05$), which meant that neither hypoxemia nor hypercapnia or acidosis, affect glycerolipid metabolism, at least to the extent of having a repercussion on their hematic concentrations. The results referring to phospholipids, agree with other publications, but not in respect to triglycerides whose rates were found lower by others (7). The quality controls in the techniques used in this work have been rigorous, so that it may be affirmed that hypoxemia, hypercapnia, and acidosis do not significantly modify triglyceride and phospholipid seric levels. The seric concentration of free fatty acids (FFA) was abnormally high in all the hypoxemic patients but the difference between the intense and moderate hypoxemic groups was non-significant (table I). If increases in acidosis do not produce appreciable changes in FFA concentration and this one rises whenever hypoxemia is present, the lack of oxygen seems to be in all likelihood the change determining factor. This interpretation agrees with others (5, 6). The relation between plasmae FFA and albumin, expressed by the FFA/albumin index, showed higher values in the hypoxemic patients than in the control group, with highly significant statistical differences (table I). This point has not been established before.

Differences of free and total seric cholesterol concentrations between the three groups were not statistically significant ($p > 0.05$), and LDL-cholesterol seric levels were also statistically alike in all groups, with analogous mean values, as found by others (7). Seric levels of HDL-cholesterol were lower in patients with moderate or intense hypoxemic state, and statistically different in respect to the normoxemic groups ($p < 0.05$). If the decrease of HDL-cholesterol in blood was really more important than the increase of LDL-cholesterol as a pathogenic factor of the atherosclerotic plaque (10, 12), chronic hypoxemia might be considered as another ethiopathogenic factor in atherosclerosis. It has been suggested that the index total cholesterol/HDL-cholesterol has a greater prognostic value than the evaluation of serum HDL-cholesterol alone, being pathological the indexes above 4.4 mmol/l in women and 4.9 in men (8). While the value of this index in the normoxemic group was in the physiological range, both hypoxemic groups surpassed the determined normality limits. The statistical comparison between the hypox-

emic group values with the control showed in both cases highly significant statistical differences ($p < 0.01$); on the other hand, there were no demonstrable differences when comparing the indexes from both hypoxemia affected groups. This seems to signify that hypoxemia is able to alter the total cholesterol/HDL cholesterol relation more than acidosis.

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Key words: Serum lipids, Lipoproteins, Cholesterol.

Palabras clave: Lípidos séricos, Lipoproteínas, Colesterol.

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