

COPPER AND CERULOPLASMIN CONTENTS IN THE BLOOD SERUM OF PERIPHERAL AND PRE-HEPATIC VEINS

H. M. CANELAS

I. ROITMAN

M. SCAFF

S. RAIA

F. B. DE JORGE

Several questions about the pathogenesis of hepatolenticular degeneration (HLD) remain unsolved, despite the extraordinary results achieved by the numerous researches carried out, mainly with radioactive copper^{9, 11, 12}. For instance, the low copper content of the stools, formerly ascribed to an increased intestinal absorption¹⁶, is now regarded as a consequence of a defective biliary excretion^{5, 10}.

However, although some facts^{5, 6, 8} seem to question the significance of the impaired synthesis of ceruloplasmin, the investigations with radiocopper¹² and other arguments^{12, 13, 15} apparently support it.

In an attempt to contribute for the unraveling of the problem, the concentrations both of copper and ceruloplasmin have been determined in samples of peripheral and pre-hepatic venous blood from 11 patients submitted to portal decompression.

MATERIAL AND METHODS

During the performance of either porto-caval or spleno-renal shunt in 11 patients with Manson's hepato-splenic schistosomiasis, blood samples from the superior mesenteric and basilic veins were collected.

Ceruloplasmin and copper contents were determined according to Houchin⁷ and a modified Gubler method³, respectively. Due care was taken in order to prevent copper contamination of the materials.

The results obtained in the samples of peripheral blood, compared to normal values^{2, 4}, showed increased copper contents in 6 cases, while all ceruloplasmin levels fitted in the normal range. In these cases, the increase of the direct reacting copper may be due to the liver damage caused by schistosomiasis.

For comparative purposes, the same study was done in a patient with HLD submitted to porto-caval shunt owing to a severe bleeding of esophageal varices.

The results were submitted to statistical treatment, by means of the analysis of the individual differences in the copper and ceruloplasmin contents of both blood samples¹.

From the Departments of Neuropsychiatry (Division of Neurology) and Surgery (3rd Division) of the University of São Paulo Medical School.

RESULTS

The results obtained in the 11 schistosomal patients are assembled in table 1.

In the patient with Wilson's disease no ceruloplasmin could be demonstrated in any of the samples, by the method employed. On the other hand, determination of the total copper content showed 30 $\mu\text{g}/100$ in the basilic vein blood, 30 in vena cava, 22 in the hepatic vein and 10 in the portal vein.

Case	Name	File n.º	Basilic vein		Superior mesenteric vein	
			Copper ($\mu\text{g}/100$ ml)	Cerulo- plasmin (mg/100 ml)	Copper ($\mu\text{g}/100$ ml)	Cerulo- plasmin (mg/100 ml)
1	M.N.A.	1088092	275*	25.5	315*	34.3
2	L.R.S.	1087770	80	21.5	75	19.7
3	C.A.C.	1087499	95	28.0	107	27.8
4	C.A.A.	1059286	123	29.4	109	25.0
5	J.L.P.	1089501	130*	28.0	115	25.0
6	O.F.S.	1091351	115	31.6	70	13.6
7	D.P.P.	1087803	—	28.0	—	32.0
8	B.F.S.	1046037	190*	39.0	180*	38.0
9	M.G.S.M.	1046772	130*	29.0	130*	32.0
10	B.S.A.	1103385	160*	26.0	150*	27.0
11	V.A.S.	1047166	150*	33.0	160*	27.0

Statistical analysis	d	t	P
Copper	3.6	0.536	\approx 0.60
Ceruloplasmin	17.6	0.777	\approx 0.45

Table 1 — Results: * high blood copper contents.

DISCUSSION

Trip¹⁴, using vascular catheterization, has determined the blood copper and ceruloplasmin contents in the brachial artery and in the hepatic and subclavian veins of 37 patients. Of the 37 patients, 25 had liver cirrhosis or other hepatic pathology, and 12 had heart diseases. Total blood copper and ceruloplasmin contents in the brachial artery were lower than in the hepatic vein. From his investigations, the author drew the conclusion that the ceruloplasmin synthesized in the liver as fraction I (C-C), which is carried to the tissues by the blood stream, part of it being inactivated or destroyed, part transformed in fraction II (C-D), and part staying in the blood as fraction I.

In our material, the differences between the copper and ceruloplasmin contents in the samples of peripheral and pre-hepatic blood were not significant, a fact which could be anticipated due to the wide dispersion of the results (Table I).

Our results, arising from an essentially different approach than Trip's, suggest that the copper content in the blood from the small bowel is not higher than that of the peripheral blood. The same result was obtained regarding ceruloplasmin*, probably because the mesenteric blood contains an appreciable amount of elements coming from the general circulation. Therefore, the mesenteric blood differs in this regard from lymph, which contains no ceruloplasmin¹⁴.

In the patient with HLD the copper content in the portal vein was markedly lower than in vena cava and the basilic vein (10 µg/100 ml instead of 30). This seems to indicate that, in Wilson's disease, even a decrease in the intestinal absorption of copper can be observed.

SUMMARY

Copper and ceruloplasmin contents were determined in samples of peripheral and pre-hepatic venous blood of 11 patients with Manson's schistosomiasis and one patient with hepatolenticular degeneration, all of which submitted either to porto-caval or spleno-renal shunt. Individual difference were not significant in any of the non-Wilsonian patients. The results are discussed in regard to the current knowledge on the pathogenesis of Wilson's disease.

RESUMO

Concentrações de cobre e ceruloplasmina no soro sanguíneo de veias periférica e pré-hepática

Foram determinadas as concentrações de cobre e ceruloplasmina em amostras de sangue venoso periférico e pré-hepático de 11 pacientes esquistossomóticos e de 1 paciente com degeneração hepatolenticular, submetidos a anastomose portocava ou esplenorrenal. Nos 11 pacientes não wilsonianos, as diferenças individuais não se revelaram estatisticamente significantes. Os resultados são comentados em relação aos conhecimentos atuais sobre a patogenia da moléstia de Wilson.

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* Although the mean difference of the copper contents is less significant than that of the ceruloplasmin contents (table 1).

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Departamento de Neuropsiquiatria, Divisão de Neurologia — Faculdade de Medicina, Universidade de São Paulo — Caixa Postal 3461 — 01000 São Paulo, SP — Brasil.