

Observations on Plasma Ammonia in Patients with Leukemia

High blood ammonia levels in patients with leukemia have been described by FULD in 1933¹; recently LARSEN and MANNING^{2,3} and BOCKEL, IMLER and STAHL⁴ confirmed an increased ammonia content of venous blood in patients with leukemia.

LARSEN and MANNING suggested that high blood ammonia results from in vitro metabolic activity of the large circulating leucocyte mass with output of ammonium ions from the leukemic cells after blood collection^{2,3}.

BOCKEL, IMLER and STAHL confirmed the cell's source

of ammonium ions but stated that the phenomenon is present in vivo⁴.

We have therefore studied the arterial plasma ammonia levels in a caselist of 20 normal subjects, 20 patients with chronic myelogenous leukemia, 6 with chronic lymphatic leukemia and 4 subjects with acute leukemia.

Methods. Blood was obtained from each patient and an aliquote immediately placed in an ice-tube, with heparin as anticoagulant: heparin, in fact, inhibits adenosine deaminase and consequently the production of ammonia from deamination of nitrogenous materials⁵⁻⁸.

Plasma was separated by centrifugation at +4°C. Ammonia was determined by a new method based on ion exchange resin as proposed by MILLER and RICE⁹ and modified by SECCHI et al.¹⁰.

Results and discussion. The ammonia values and leucocyte counts are expressed in Tables I and II. Plasma arterial ammonia levels are statistically increased in leukemic patients. In chronic leukemia a correlation was revealed between WBC counts and ammonia levels; in acute leukemia no correlation was observed.

The prompt refrigeration of blood samples and the ion exchange resin method which we adopted did not, in our opinion¹¹, permit the occurrence of 'laboratory phenomenon' of ammonia production by an enzymatic process following the collection of blood. We cannot, however, exclude a possible cell lysis. No patient showed neurological symptomatology: in fact, in our caselist plasma ammonia levels did not reach the high values detectable in hepatic pre-coma and coma¹².

Table I.

Normal subjects	20	mean 14.20	S.D. \pm 3.74
Leukemic patients	30	mean 47.13	S.D. \pm 20.54
Analysis of variance			
Source of variation	Degrees of freedom	Sum of squares	Mean squares
Between groups	1	13014	13014
Within groups	48	12544	261
Total	49	25558	
			F = 49.86 P < 0.01

Table II.

Diagnosis	Patient	WBC	Arterial ammonia ($\gamma\%$)
Myelogenous leukemia	L.D.	66,400	40
	U.R.	72,000	46
	V.A.	12,200	20
	E.G.	8,600	22
	M.P.	22,000	25
	R.Z.	48,400	45
	M.M.	36,000	40
	L.T.	74,000	53
	M.V.	40,000	43
	L.M.	96,000	80
	T.A.	38,000	35
	G.N.	18,000	25
	R.R.	28,000	38
	N.B.	56,000	45
	L.T.	48,000	55
	E.G.	37,600	40
F.B.	57,900	60	
S.C.	83,000	72	
A.V.	19,600	28	
Z.I.	61,000	55	
Lymphatic leukemia	A.C.	102,000	96
	U.V.	28,000	24
	N.L.	46,800	25
	G.T.	34,000	45
	R.E.	54,000	47
	F.D.	41,800	32
Acute leukemia	C.B.	70,000	66
	E.V.	30,400	47
	S.F.	56,000	65
	V.L.	82,000	100

Riassunto. In una casistica di 50 pazienti affetti da leucemia acuta e cronica sono stati riscontrati elevati livelli dell'ammoniaca arteriosa plasmatica. Viene discussa l'origine degli ammonio-ioni presenti nel plasma.

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