Nutrient Profile of Hypothermics

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Abstract

Three abnormal, young female hypotherms with mental retardation had basal temperatures of 88 degrees. Endocrinological evaluations were all negative. An evaluation of nutritional factors was undertaken. No significant changes were found in serum zinc, copper, iron and histamine. Twenty-three nutrients measured in hair showed significant elevations in strontium and sulfur. Analysis of plasma amino acids showed decreases in leucine, isoleucine, valine, tyramine, proline and histamine with elevations in glutamic acid and cystine, when compared to 45 patient controls. The data was confirmed by another laboratory which, in addition, found that taurine and serine were also decreased. In contrast, valine and glutamic acid were elevated. The data is of interest because of postulated roles of amino acid neurotransmitters and their products in thermoregulation. Abnormal amino acid metabolism may account for some of the hypothermia in these patients. The abnormalities in the amino acid levels might also be the result of the hypothermia and not its cause.

Introduction

Three young female hypotherms, ages 22, 23 and 24, had a basal temperature of 88 degrees. These mentally retarded patients had to be kept in specially heated rooms. Yet, no endocrinological abnormalities had been identified to account for their condition. We therefore, undertook an evaluation of their nutrient status compared to contols,

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hoping to further elucidate the cause of their condition.

Methods

A Beckman 6300 amino acid analyzer was used by both Monroe and Doctor's Data (commercial laboratories) who analyzed the plasma amino acids. The Princeton Brain Bio Center determined the zinc, copper and iron levels by using a Perkin Elmer 3030 atomic absorption spectrophotometer. Histamine and polyamines were determined fluorometricly after chromotographic separation on an ion exchange cellulose column. Hair tests were done by Doctor's Data by ICP, using emission spectroscopy.

Patients:

***Case* #1**

J.D. is a 23-year-old female with profound mental retardation associated with prematurity and possibly congenital toxoplasmosis. She is legally blind with cataracts, has mild spastic quadriplegia, generalized mixed motor seizures and chronic hypothermia.

A CAT scan showed intracranial calcification. Seizures are fairly well controlled with Phenobarbital at a dose of 30 mg b.i.d.

Body temperature by rectal thermometer ranges from 93-96 degrees F. She becomes more alert, active, cheerful with a better appetite at the higher temperature.

Case #2

J.P. is a 22-year-old female with profound mental retardation due to postnatal cerebral infection. She has severe spastic quadriplegia, contractures, scoliosis, and a history of generalized mixed motor seizures. Her medications include Phenobarbital and Vitamin D supplementation. Chronic hypothermia is manifested by

temperatures below 96 degrees F, lethargy, and anorexia responds to an ambient temperature of 80-85 degrees F, when her body temperature increased.

Case #3

H.M. is a 23-year-old female with profound mental retardation due to hydrocephaly with subdural hematoma. She has generalized mixed seizures, severe spastic quadriplegia, cataracts, recurrent respiratory infections. Medications include Tegretol, Dilantin, and Phenobarbital, for seizure control as well as Folic acid and vitamin D.

Recurrent hypothermia with rectal temperatures below 96 degrees F was associated with lethargy and anorexia which was reversible with ambient temperatures of 80-85 degrees F.

Results

The three patients with hypothermia had an in-patient endocrinology workup which included:

TSH T4RIA T3 uptake Serum glucose Serum electrolytes Serum Cortisol Cat scan of brain

J.D. showed intracranial calcification possibly associated with congenital toxoplasmosis. All other of the above studies were within normal limits.

Three hypotherm patients were compared to matched controls and showed no significant changes in serum zinc, copper and iron, and whole blood histamine or polyamines. There was a downward trend in zinc and histamine in the three hypothermic patients. Hair analysis revealed a significant elevation of strontium and sulfur for all three patients. There were no other significant changes in 23 nutrients and toxic metals in hair. There was a trend upward in the calcium, magnesium and zinc content. The significance of these elevations was unclear.

The most meaningful data came from the amino acid studies. A comparison of 45 matched (unmedicated, no significant differences in age of controls) patients of the Princeton Brain Bio Center with the three fasted hypotherms showed several amino acids were significantly low for the latter group.

Leucine, isoleucine, valine, tyrosine, proline, and histidine were significantly low in the hypothermic patients (in comparison to Brain Bio Center controls done by Monroe Labs). Cystine and glutamic acid were significantly elevated. To investigate these unusual data, we also compared them to Monroe Medical Laboratory's normal ranges. Similar results were found with even greater significance. Again, these amino acids were found to be significantly reduced. Further comparison was done by having Doctor's Data analyze another sample. Doctor's Data Laboratories confirmed that there were several lower than normal plasma amino acids in hypothermic patients; taurine, serine, proline, isoleucine, phenylalanine, ornithine, lysine, histidine and tyrosine. Elevations were found in valine and cystine. Both outside labs (control groups) and our out-patient controls observed that cystine was elevated and that proline, tyrosine, histidine, leucine and isoleucine were all reduced. The difference between the results of these two laboratories (Monroe and Doctor's Data) may be one of method or due to the different periods of time in which the bloods were drawn. The general decrease in plasma amino acids has been observed by us in hospitalized patients but cystine elevations have not been observed. Hence, the elevations in plasma cystine in three retarded hypothermic patients is most interesting, although not consistent with any inborn error of metabolism.

Conclusion

The data was of interest because of postulated roles of amino acid neurotransmitters as modulators in mammalian thermoregulation (Bligh, 1981, Blat-teis, 1981). Various studies have shown that many amino acids (taurine, GABA) injected intraventricularly can elevate temperature. The data in regard to histidine and histamine is of interest because of postulated roles of histamine in hypothermic thermoregulatory pathways (5). A direct relationship between many plasma amino acids and neurotransmitter levels has been well established. Furthermore, techniques

Table I

3 Hypotherms vs. 45 Brain Bio Patients Plasma Amino Acids On No Therapy (micromoles/l00 ml)

Leu			6.5 + 2.2		P < .04
			4.0 + 1.7		
He			21.2 + 5.9		P < .03
			14.3 + 3.2		
Val			2.9 + 1.5	P	< .02
			5.0 + 1.0		
Cys			7.0 + 2.2		P < .03
			4.3 + 1.5		
Tyr			19.8 + *7.7*		P < .03
			10.6 + 1.5		
Pro			3.2 + 1.4		P < .001
			9.0 + 7.0		
Glu			9.5 + 2.3		P < .04
			7.0 + 1.0		
His			11.7 + 3.0	N = 45	P < .03
			8.0 + 2.6	N = 3	

like epinephrine or ephedrine (1) treatment which lower plasma amino acids can induce thermogenesis. The relevance of these findings might be elucidated by restoring the patients to room temperature and repeating amino acid evaluation.

In summary, there seems to be good evidence that there are abnormal amino acid levels found in the plasma of these three hypothermic patients. This finding may be of some significance in that numerous amino acids have been implicated in temperature regulation. Thermo-regulatory amino acids are GABA, tyrosine, taurine, histidine, cysteine, serine and alanine (£). Abnormal amino acid metabolism may account for some of the hypothermia in these patients. The abnormalities in the amino acid levels might also be the result of the hypothermia and not its cause.

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