BRIEF REPORT

Albumin Warao: New Type of Human Alloalbuminemia

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HUMAN ALLOALBUMINEMIA—to use the term coined by Blumberg et al.1—is characterized by the presence of types of albumin that electrophoretically migrate faster or slower than common albumin. The nomenclature used by the two most active groups in this field and the relative migration of the albumin variants are shown in Figure 1.

The possible association of these variants with clinical or biochemical alterations is under active investigation. Earle et al.2 and Tarnoky and Lestas3 have reported elevated cholesterol levels associated with albumin variants. High incidence of bone and joint complaints and bad hearing was found by Laurell and Nil\éhn4 among members of a family with a slow albumin variant. Blumberg et al.1 called attention to the fact that differential binding of many physiological materials, dyes, and drugs, already demonstrated in albumin variants, could be of clinical importance in carriers of anomalous albumins, specially in the American Indians. Population genetic and physical anthropology may benefit from the search for these genetic traits in primitive and mixed populations, as specific variants have been recently described in them (albumin Naskapi in northern North American tribes,1,5 albumin México in a Mexican tribe,6 and albumin Mák in a Brazilian tribe7).

This report concerns a new albumin variant found during the course of a multidisciplinary study on the anthropological, genetic and hematologic aspects of the Venezuelan Warao Indians.

 MATERIALS AND METHODS

A batch of 222 serum samples from Warao Indians living at the villages Winikina, Jobure and Sacupana (Orinoco Delta) was studied. When feasible all family members were included in the survey and extensive pedigrees were gathered.

Immunoelectrophoresis in agar gel pH 8.6 was made using as antibody a Hyland horse antiserum to human albumin. Electrophoresis were performed for 20 minutes in cellulose
ALBUMIN WARAO

Fig. 1.—Relative electrophoretic mobility in inherited albumin variants, including terminology in use. Albumin Carib and albumin Caracas are new variants, found in a Venezuelan descendant of Carib Indians and a patient from Caracas, respectively (to be reported in detail elsewhere).

acetate with barbital buffer pH 8.6 and in horizontal starch gel for 16 hours at 4 C., with a buffer (pH 5.3) adapted for studying albumin variants, which contains 1 vol. of solution A (39.5 Gm. of citric acid, 11.1 Gm. of LiOH anhydrous, in 1 liter of water) and 9 vols. of solution B (succinic acid 0.01 M, and trishydroxymethyl aminomethane 0.0184 M) and for the vessels using solution A diluted 3:1.

Having observed that storage diminished the level of albumin Warao, a heat determination test was performed by incubating serum at 56 C. for 30 minutes and then verifying the effect by cellulose acetate electrophoresis.

Results

Only one family which belonged to the Winikina village was found to present an anomalous fraction migrating between the post-albumins and the fast a2-globulins in starch gel electrophoresis and behind the albumin in cellulose acetate (Fig. 2). In either alkaline or acid pH this new variant is slower than all the variants already described. Immunoelectrophoresis showed two arcs at the albumin region (Fig. 3).

The new variant was found in three generations and in 5 out of 9 members tested (Fig. 4). Blood groups and serum groups studied in this family are tabulated in Table 1.

Thermal instability test revealed that this new variant when subjected to heat, becomes denatured under the conditions indicated, in contrast with common albumin and albumin B which do not become altered when subjected to the same temperature. The amount of the new albumin variant ranged in this family from 23 per cent to 37 per cent with a mean of 29 per cent of the corresponding normal albumin, as calculated by desitometric curve of the cellulose acetate electrophoresis strip. This finding differentiates albumin Warao from most albumin variants which usually are approximately equal to the amount of normal albumin, the difference suggesting that albumin Warao could be a dimeric variant.
Atbumins

Fig. 2.—Electrophoretic migration of Warao albumin. A. In cellulose acetate albumin Warao separated neatly from common albumin as well as from $\alpha_1$-globulin. B. Starch gel. Position 1, 2, 5: Albumin Warao; 3: México; 4: B.

According to the terminology for genetic traits in use today, the new albumin variant found, is tentatively called albumin Warao and the heterozygous form expressed as A/W. The symbol W may be used to designate the gene.

DISCUSSION

The Warao (Warau, Guaraunos, Guaraos), constitute a tribe of approximately 12,000 subjects living in the Orinoco Delta and in the adjacent regions of Guyana (lat. 8–10°N.; long. 59–62°W). Their cultural characteristics differ markedly from their neighbours of Carib and Arawakan affiliation. Wilbert\(^8\) considers that they had at one time cultural relations with the Andes popula-
Fig. 3.—Immunoelectrophoresis using horse anti-albumin. (a), (b), (c) and (d) human serum with common albumin only; (e) and (f) human serum with common albumin and albumin Warao.

tions, and speculated that “before the Warao migrated to the Orinoco Delta, they lived in Western Venezuela possible near the Andes.” Various biologic studies made in the Warao have demonstrated that they lack abnormal hemoglobins, that all have blood group O and that the Rhesus blood gene complexes $cde$ and $cDe$ are absent; the incidence of the blood group M is low and the $S$ gene travels more with $M$ than with $N$; they have a very low frequency (3 out of 153) of the Diego blood group antigen. The transferrin $D_{\text{rh}}$, typical of certain Mongoloid populations, has been found in the Warao. No variants of the usual serum pseudocholinesterase (acylcholine acylhydrolase) were found in 131 Warao studied. Thus, this tribe can be considered to be practically without admixture with Caucasoids or Negroids, but they probably have mixed, in a very small degree, with Carib or Arawak Indians, who live in peripheral areas of the Warao habitat. Nevertheless, strong economic and cultural pressures of the advancing frontier are likely to cause significant changes of this status in the near future.

The finding of this “new” albumin variant in the Warao Indians is another important step towards the biologic characterization of this tribe. Although
Fig. 4.—Pedigree of the Warao family from Winikina showing albumin genotypes. Notice the male to male transmission of the albumin Warao from generation II to III. (Squares designate males, circles females).

Table 1.—Data on the Winikina Family Studied

<table>
<thead>
<tr>
<th>Individual number</th>
<th>Sex</th>
<th>Serum types* Alb</th>
<th>Hp</th>
<th>MNSs</th>
<th>Blood types* P Kidd (JR*)</th>
<th>Lewis a b</th>
</tr>
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<tbody>
<tr>
<td>I – 2</td>
<td>F</td>
<td>A/W †</td>
<td>2-1</td>
<td>MNSs</td>
<td>0 0 − +</td>
<td></td>
</tr>
<tr>
<td>I – 3</td>
<td>M</td>
<td>A/A</td>
<td>2-1</td>
<td>MNSs</td>
<td>0 + − −</td>
<td></td>
</tr>
<tr>
<td>II – 1</td>
<td>F</td>
<td>A/A</td>
<td>2-1</td>
<td>MNSs</td>
<td>+ 0 − +</td>
<td></td>
</tr>
<tr>
<td>II – 2</td>
<td>M</td>
<td>A/W</td>
<td>2-1</td>
<td>MNSs</td>
<td>+ 0 − +</td>
<td></td>
</tr>
<tr>
<td>II – 3</td>
<td>F</td>
<td>A/A</td>
<td>2-1</td>
<td>MNSs</td>
<td>0 + − −</td>
<td></td>
</tr>
<tr>
<td>II – 6</td>
<td>M</td>
<td>A/A</td>
<td>1-1</td>
<td>MNSs</td>
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<td></td>
</tr>
<tr>
<td>II – 8</td>
<td>M</td>
<td>A/W</td>
<td>2-1</td>
<td>MNSs</td>
<td>0 + − −</td>
<td></td>
</tr>
<tr>
<td>II – 9</td>
<td>M</td>
<td>A/W</td>
<td>2-2</td>
<td>MNss</td>
<td>0 + − −</td>
<td></td>
</tr>
<tr>
<td>III – 1</td>
<td>M</td>
<td>A/W</td>
<td>2-1</td>
<td>MNSS</td>
<td>0 + − −</td>
<td></td>
</tr>
</tbody>
</table>

* All individuals tested were transferrin type C, Gc type 1-1, pseudocholinesterase type C5 negative, Rh type DCCee, Duffy type Fy(a+b−), Kell type kk and Diego type Di(a−).
† A is the symbol for common albumin and W for albumin Warao.
‡ Possible extra-marital child.

Preliminary evidence obtained in a general survey of alloalbuminemia in the Venezuelan population suggests that this new variant is not uncommon among the Venezuelan natives. Those in whom this variant has been found are not necessarily of Warao extraction but they might stem from other Venezuelan Indians (this is still under study). This raises the hypothetical question of whether this results from intermixture of migrating Warao with other tribes or whether it represents a genetic trait common among the South American Indians.

According to the form in which the variant appears in the family studied (Fig. 4) and considering what has been found in other types of albumin, it is possible to postulate that this variant is also inherited as a simple autosomal co-dominant trait, the carriers of this variant being heterozygous for common albumin and the new albumin (A/Warao). Weitkamp et al. reviewed the hereditary aspects of all the albumin variants reported and found that up to date “male-to-male transmission” of some albumin variants had not been described. Our Warao family has this type of inheritance. The albumin locus has
been described as closely linked to the locus for the genes determining the \( Gc \) groups,\(^\text{17} \) but since all individuals of this family were \( Gc \) type 1–1, there was no opportunity to confirm this.

To our knowledge this is the first instance that thermal instability has been reported in relation with an albumin variant, a characteristic with potential biochemical and clinical implications that should be studied further.

**SUMMARY**

A new albumin variant characterized by the slowest electrophoretic migration at both acid and alkaline pH, was found in a Warao Indian family from Venezuela. Thermal instability of an albumin variant is described for the first time.

**SUMMARIO IN INTERLINGUA**

Un nove variante de albumina, characterisate per le plus lente migration electrophoretic in medios a pH tanto acide como alcalin esseva trovate in un familia de indians Warao de Venezuela. Instabilitate thermic de un variante de albumina es describite pro le prime vice.

**ACKNOWLEDGMENT**

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**REFERENCES**


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