Relato de Caso

Hemoglobin Kansas found by electrophoretic diagnosis in Brazil

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Some hemoglobin variants with abnormal oxygen affinity have been reported so far from various regions of the world. They can be classified by their oxygen affinity and 15 variants with low oxygen affinity have been reported. A number of hemoglobin mutants which show an abnormal affinity for oxygen have been reported, but only few cases of hemoglobin Kansas. All cases reported so far are from Japan or in Japanese families. In this paper we describe a Brazilian patient with cyanosis and hemoglobin Kansas diagnosed by an electrophoretical procedure.
Rev.bras.hematol.hemoter.,2002;24(1):37-39

***Keywords**: Hemoglobin Kansas, electrophoretic diagnosis, abnormal hemoglobins*

Introduction

Hemoglobin Kansas is characterized by an unusual low oxygen affinity. Since this is the major cause of cyanosis in carriers, it is of interest that dark blood samples containing hemoglobin Kansas turn almost red after vigorous shaking with air, in contrast to the dark brown color which remains in the case of methaemoglobinaemia or the hemoglobin M disease (1).

Hemoglobin Kansas is also characterized by tendency for subunit dissociation, auto-oxidation and heat liability. It differs from normal hemoglobin in its equilibrium with oxygen, its tendency to dissociate into subunits and its chromatographic behavior. These differences appear to be associated with a single neutral substitution in the β chain [β 102 (G4) Asn→Thr]. This is a residue in the internal interface with heme and alpha-1 beta-2 contact. In the heterozygosity the hematology is normal (2, 3).

More than 50 Hemoglobin variants with abnormal oxygen affinity have been reported so far from various regions of the world (4). Hemoglobin Kansas is a variant Hb with low oxygen affinity. The structure-function relationship of this hemoglobin has been studied in detail (5). Residue G4 appears to be oriented "inward" into the heme, and the group with which it makes contact is not yet known (6, 7).

Case report

The proposita is a 21 year-old Caucasian woman from Cuiabá, MT, with cyanosis and hematological values as follows: RBC count $5.6x10^6/mm^3$; Hemoglobin 18.3 g/dl; Hematocrit

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53%; WBC count 9,300/mm^3; platelet count 205,000; red cell morphology normal, mean corpuscular volume 94.5/fl; mean corpuscular hemoglobin concentration 34.5g/dl.

She had been healthy with no suggestions of illnesses compatible with heart or blood disease. Physical examination was negative except for cyanotic lips. An electrocardiogram and an echocardiogram gave normal results. The liver, spleen and kidneys were not palpable.

A sample of arterial blood obtained while the patient was undergoing oxygen inhalation therapy, was very dark with partial oxygen pressure (PO_2) at 102.40 mm Hg, partial carbon dioxide pressure (PCO_2) at 31.80 mm Hg and pH 7.39.

In cellulose acetate electrophoresis at alkaline pH (8), the sample hemolysate showed an abnormal band with mobility like Hb F. Quantification by densitometry was 38.4%. In acid pH electrophoresis the sample showed an Hb A pattern.

The abnormal component was also found in agarose gel plate isoelectric-focusing (9), between Hb A and F. Globin chain electrophoresis at 8.6 pH showed a band for the beta mutant position. The isopropanol test was normal and somewhat unstable in relation to heat denaturation.

It was impossible to make a familiar study in this case. According to these results, the patient's hemoglobin appeared to be heat labile, have a low heme-heme interaction and low oxygen affinity.

Discussion

Hb Kansas was reported by Reissmann *et al* and also by Ishiguro *et al* in 1983 in Japan. Until 1992 only three cases were reported in the world (4).

More than 50 hemoglobin variants with abnormal oxygen affinity have been reported so far from various regions of the world. They can be classified by their affinity for oxygen, and 15 variants with low oxygen affinity have been reported including Hb Kansas. The structure-function relationships of Hb Kansas have been studied in detail (6).

Stability of normal adult hemoglobin depends upon the maintenance of the satisfactory spatial relationship between the two alpha and two beta chains. Amino acid substitutions may weaken the links that hold the tetramer together. Hemoglobin Kansas has an amino acid substitution, β 102(G4)Asn>Thr, which weakens the contacts along the $\alpha 1\beta 2$ interface. The main clinical feature of this abnormal hemoglobin is, however, not an instability but a very low oxygen affinity. Because of the great quantity of circulating reduced hemoglobin cyanotic carriers of hemoglobin Kansas were originally thought to have methaemoglobinaemia. Hemoglobin Kansas is associated with no clinical abnormalities other than cyanosis.

It is noteworthy that in this case the patient had slight cyanosis and characteristic hematological data. The electrophoretic results and hematological data allowed us to conclude that the proposita was a carrier of hemoglobin Kansas.

Hemoglobina Kansas diagnosticada através de eletroforese no Brasil

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Resumo

Hemoglobinas variantes com afinidade anormal ao oxigênio têm sido encontradas em várias partes do mundo. Pela sua afinidade ao oxigênio, estas hemoglobinas variantes têm sido classificadas e 15 variantes com baixa afinidade relatadas. Numerosas hemoglobinas mutantes com afinidade anormal têm também sido relatadas, mas somente poucos casos de Hemoglobina Kansas. Os casos são de pacientes procedentes do Japão, ou de famílias com descendentes japoneses. Neste relato descrevemos um paciente com manifestações de cianose que teve o seu diagnóstico confirmado através da eletroforese.

*Rev.bras.hematol.hemoter.,2002,**24**(1):37-39*

***Palavras-chave**: Hemoglobina Kansas, eletroforese, hemoglobinas anormais*

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Recebido: 17/07/01
Aceito: 13/02/02