Change of blood group from A₂ to A_x in a child with congenital abnormalities

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SYNOPSIS A blood group change from A₂ to A_x is described in a boy who had Fallot's tetralogy, oesophageal atresia, and a tracheo-oesophageal fistula. The change of blood group created a transfusion problem. The unusual serology is discussed.

A_x (A₄, A₀, etc.) is a rare variant (Race and Sanger, 1968) of the human blood group antigen A. A_x red cells are not agglutinated, or sometimes weakly agglutinated, by group B sera (anti-A) but are strongly agglutinated by group O sera (anti-A + B). It is important to use many anti-B and anti-A + B sera to distinguish between A₂ and A_x because some anti-B sera react fairly well with A_x cells. Group A_x secretors secrete H but usually no A-substance or, in rare instances, faint traces of it. The serum of A_x people is said usually to contain anti-A₁.

In most families A_x is controlled by an A_x gene. In others there is evidence of the effect of modifying genes or, more likely, of allelic enhancement (C. Salmon, personal communication). Two families have been reported (van Loghem and van der Hart, 1954; Beckers *et al*, 1955) in which both parents were group O and the child A_x. In another family an A₂B man transmitted A_x to his daughter (Cahan *et al*, 1957).

We here report a blood transfusion problem which arose in an unusual A_x patient.

Case Report

SURGICAL

P.W. (male, born 27 June 1971) was first admitted to hospital on 27 June 1971. In was his mother's second pregnancy (first child normal), and the child was delivered at 37 weeks' gestation. His mother had had hydramnios during pregnancy. A radiograph of

the child's chest at this time showed a Fallot-type heart and, in addition to oesophageal atresia, there was a tracheo-oesophageal fistula. The tracheo-oesophageal fistula was disconnected from the trachea (K.D.R.) on 27 June 1971, and it was decided to carry out a delayed reconstruction of the oesophagus.

The child was again admitted in March 1972 for reconstruction of the oesophagus, in November 1972 for cardiac assessment, and again in October 1973 for corrective surgery for the cardiac lesion. This was carried out on 16 October using cardiopulmonary bypass and a diluted blood prime of the heart/lung machine. The boy's progress after operation was uneventful and he was discharged home on 25 October 1973, at which time he had full activity and no signs of cardiac failure.

SEROLOGY

P.W.'s mother had been investigated antenatally and was known to be a typical A_x; a subsequent family study showed that she had inherited this character from her father (figure). At birth P.W. was a typical A₂, his red cells were agglutinated by several examples of both anti-A and anti-A + B sera; they reacted very weakly with the *Dolichos biflorus* lectin. We were not disturbed by this observation because, as stated above, the inheritance of A_x is not always straightforward. Before cardiac surgery, however, P.W., who previously grouped as A₂, was found to be a typical A_x; his red cells were negative with all of 12 anti-A sera, strongly positive with 12 anti-A + B, and negative with *Dolichos biflorus*. Since antigens of the ABO system are usually weaker at birth than later in life, the change from A₂ to A_x is remarkable. Furthermore, his serum was found to react with A₁ cells to a titre of 64 and A₂ cells to a titre of 16.

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Figure Family tree of P.W.

Absorption tests showed that both anti-A and anti- A_1 were present.

Transfusion Problem

This case was complicated enough from the purely surgical point of view; the unusual serological features presented an additional problem. Cardiac surgery requires a relatively large amount of blood. Because of strong anti-A antibodies in the patient's plasma, group A blood could not be used. Group O whole blood was also contraindicated because group O plasma strongly agglutinates group A_x cells. The heart/lung machine was therefore primed with thrice-washed group O cells resuspended in sterile pyrogen-free Hartmann's solution. There were no complications.

Discussion

The apparent change of P.W.'s blood group from A_2 to A_x suggests the possibility that, as he grew older, a conformational change took place on the red cell surface, so that his red cells were no longer agglutinated by anti-A sera. This idea is not without precedent; a conformational change in the erythrocyte surface is believed to explain the change from i to I, which normally occurs at the age of about 18 months. An alternative possibility is somatic mutation with either loss or modification of the blood group gene.

Spivey and Widmann (1974) have reported a similar change, A_2B to A_xB , in a 50-year-old woman after a successful operation for carcinoma of the cervix, and refer to two other examples, both

associated with malignant disease. There was, however, no evidence of malignancy in our patient. In Spivey and Widmann's patient, a genetic A_2B changed to A_xB ; our patient, however, appears to have reverted from A_2 to his true genetic group A_x .

Spivey and Widmann (1974) suggest that the change from A_2B to A_xB can be explained by postulating systemic loss of N-acetylgalactosaminyl transferase (in their case A_2 -gene specific transferase). We intend to do transferase studies on our patient and his family when he is older.

Although it is widely held that the antibody usually present in A_x plasma is anti- A_1 , inspection of the protocols of tests on our A_x blood donors and on another A_x person (Dunsford, 1955) show that the antibody is often not only anti- A_1 , that is, an antibody specific for A_1 cells, but also anti-A, an antibody which acts more strongly on A_1 than on A_2 cells. This is also the experience of H. G. Koster (personal communication). The patient of Spivey and Widmann (1974) also had both anti-A and anti- A_1 in her serum. The anti-A antibody in P.W.'s plasma was much stronger than any we have previously seen in an A_x person.

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