Prenatal diagnosis of \(\beta\)-thalassaemia by fetal red cell concentration with anti-AB serum\(^1\)

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SUMMARY Prenatal diagnosis by globin chain synthesis analysis on fetal blood samples obtained by placental aspiration was performed in two pregnancies at risk for \(\beta\)-thalassaemia. Since both fathers had blood group AB, and both mothers had group O, fetal red cell concentration from maternal-fetal mixtures was obtained with the aid of anti-AB serum. With this approach it was possible to carry out globin chain synthesis analysis with very small amounts of fetal blood. Heterozygous and normal genotypes were ascertained and confirmed after birth.

In the last few years, prenatal diagnosis of inherited haemoglobin disorders by fetal blood sampling and globin chain synthesis analysis of fetal red cells has been found to be feasible (Kan et al., 1975, 1977; Alter et al., 1976; Alter and Nathan, 1978; Fairweather et al., 1978; Kan, 1978).

The elimination of the maternal contribution to globin chain synthesis in mixed maternal-fetal blood samples has been carried out in three ways: (1) transfusion of the mother to suppress red cell production (Alter et al., 1978; Fairweather et al., 1978); (2) fetal red cell concentration with differential agglutination, using anti-i serum (Kan et al., 1975, 1977); and (3) differential lysis of maternal cells with the \(\text{\O}_{e}\)-skov-Stewart-Jacobs reaction (Alter et al., 1976). Since high titre anti-i is rare, given certain blood group combinations in the parents, fetal red cell enrichment could be obtained with other antibodies against blood group antigens (ABO, MNs, Rh systems).

This paper reports the results of prenatal diagnosis in two couples at risk for \(\beta\)-thalassaemia, carried out by differential agglutination of fetal red cells with anti-AB serum, as the fathers’ blood groups were AB and the mothers’ O.

Subjects and methods

Two couples, one of Sardinian origin (case 1) and

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Prenatal diagnosis of $\beta$-thalassaemia by fetal red cell concentration with anti-AB serum (Ortho Diagnostic Inc., New Jersey, USA). The tubes were spun at 300 rpm for 2 min. The red cells were then suspended in 4 ml anti-AB serum diluted 1:50 in saline. This suspension was left to sediment for 20 min, after which the supernatant was aspirated. This procedure was repeated until the supernatant was clear. After this, the samples were tested with the Kleihauer stain.

The globin extraction and globin chain synthesis analysis were carried out according to the method of Kan et al. (1969).

Results

The samples obtained with anti-AB differential agglutination were composed of a nearly pure fetal red cell preparation (Fig. 1).

In case 1, the $\beta/\gamma$ ratio was 0.038 (Fig. 2) and in case 2 it was 0.10; in the latter case the $\beta/\gamma$ ratio after differential agglutination with anti-i was 0.11. These values are in the range found in heterozygous $\beta$-thalassaemia and normal mid-trimester fetuses, respectively (Table). Both diagnoses were confirmed by globin chain synthesis analysis on cord blood. ABO blood group determination showed both newborn babies to be group A.

Table $\beta/\gamma$ ratios in fetuses at risk for $\beta$-thalassaemia

<table>
<thead>
<tr>
<th>Case</th>
<th>$\beta/\gamma$ ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1</td>
<td>0.038</td>
</tr>
<tr>
<td>Case 2</td>
<td>0.10</td>
</tr>
<tr>
<td>8 normal fetuses*</td>
<td>0.084–0.12</td>
</tr>
<tr>
<td>26 $\beta$-thalassaemia trait fetuses*</td>
<td>0.028–0.075</td>
</tr>
<tr>
<td>23 homozygous $\beta$-thalassaemia fetuses*</td>
<td>0.00†</td>
</tr>
</tbody>
</table>

*, unpublished results; †, in one case at risk for $\beta^+\alpha$-thalassaemia a $\beta/\gamma$ ratio of 0.05 was found.

**Fig. 1** Kleihauer stain after differential agglutination with anti-AB serum.

**Fig. 2** Chromatogram of a placental blood sample of case 1. $-{\H_s}$ leucine incorporation; --- absorbance at 280 nm. Unlabelled newborn and sickle cell trait haemolysates were added to the sample as carriers.
Discussion

The study of these two pregnancies at risk for β-thalassaemia showed that the concentration of fetal red cells from maternal-fetal mixtures, for prenatal diagnosis of β-thalassaemia, can be carried out in selected cases with anti-AB serum instead of anti-i serum.

Differential agglutination with anti-AB serum was possible even with minimal fetal red cell concentration in very small blood samples; this would not have been possible with anti-i serum (Kan et al., 1977). Anti-AB differential agglutination produces no modification in the β/γ ratio.

Complete blood group testing should be carried out in both members of a couple before attempting prenatal diagnosis of β-thalassaemia, in order to find genetic paternal-maternal blood group combinations which permit the use of antibodies other than anti-i for fetal red cell concentration.

References


Requests for reprints to Professor Antonio Cao, 2nd Pediatric Clinic, Via Porcell 1, 09100 Cagliari, Sardinia, Italy.
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