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Transferrin receptor expression in fetal blood mononuclear cells

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Differences in nucleated cell surface antigen expression between fetal and maternal blood has been the basis for attempts at isolating fetal cells from the maternal circulation (Bianchi *et al.* 1990). However, it has recently been suggested that the transferrin receptor may not be a suitable antigen for this purpose because it is expressed in only 20% of fetal blood mononuclear cells at term (Ganshirt-Ahlert *et al.* 1992). The aim of this study is to determine whether transferrin receptor expression in fetal blood is higher in early pregnancy when prenatal diagnosis is more appropriate.

In a cross sectional study of 25 pregnancies, fetal blood samples were obtained (1) by fetal cardiocentesis from five women undergoing elective terminations of pregnancy for social indications at 13 to 17 weeks gestation; (2) by cordocentesis from 13 women having rapid fetal karyotyping at 18 to 35 weeks; and (3) by umbilical cord puncture at delivery from seven women undergoing elective caesarean section at 38 to 42 weeks. In the women undergoing cordocentesis, the fetal biometry and karyotype was normal, and all the infants in the elective caesarean section group had birthweights above the 5th centile for gestation. Gestation was determined from the menstrual history and confirmed by fetal biometry. The study was approved by the hospital ethics committee, and all women gave written informed consent.

Fetal blood (1·5 ml) was collected for karyotyping (cordocentesis group only), full blood count, differential nucleated cell count and measurement of transferrin receptor expression. For the latter, a mononuclear cell suspension was produced by density gradient centrifugation, before staining with a fluorescein-conjugated monoclonal antibody to the transferrin receptor (Omerod 1990). Control staining of fetal cells with antimouse monoclonal IgG_{2a}-phycoerythrin/IgG_1-fluorescein was performed on each sample, and background readings of <1% were obtained (CD71-FITC and IgG_{2a}-PE/IgG_1-FITC; Becton Dickinson, Oxford, UK). A minimum of 5000 cells were acquired and analysed using a Becton Dickinson FACScan and Consort 32 software as described previously (Thilaganathan *et al.* 1992).

Results

There were significant associations between the percentage of transferrin receptor positive blood mononuclear cells and both gestational age ($r = 0{\cdot}889$, $P<0{\cdot}001$) and erythroblast count ($r = 0{\cdot}796$, $P<0{\cdot}05$) (Fig. 1). Mann Whitney *U* tests demonstrated that the median transferrin expression at 13 to 17 weeks (92%) was significantly higher ($z = 3{\cdot}21$, $P<0{\cdot}001$) than at 18 to 35 weeks (55%), which was signicantly different ($z = 2{\cdot}58$, $P<0{\cdot}01$) from that at 36 to 40 weeks (36%).

Discussion

Iron is an essential element for cell growth and proliferation, and almost every nucleated cell possesses transferrin receptors. In postnatal life, blood mononuclear cell transferrin receptor expression is very low and is limited primarily to activated lymphocytes. In contrast,

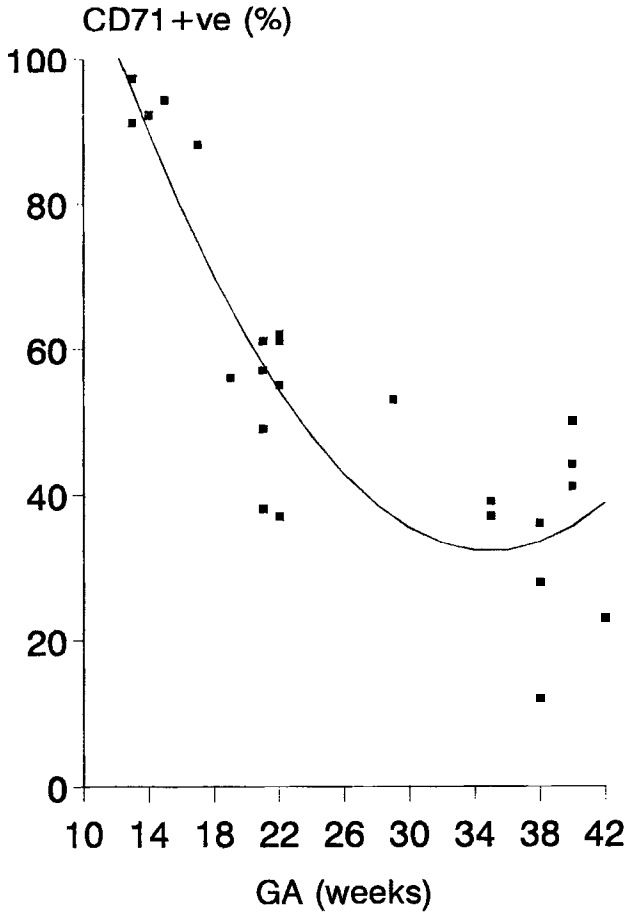

Fig. 1. Relation of transferrin receptor expression (CD71+ve) with gestational age ($r = 0{\cdot}889$, $P<0{\cdot}001$).

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nucleated haemopoietic precursors, which are usually confined to the marrow, have high transferrin receptor expression (Newman *et al.* 1982). The findings of this study that there is high transferrin receptor expression in blood mononuclear cells in fetal life, and the association with the erythroblast count, demonstrate that there are large numbers of circulating haemopoietic precursors. Furthermore, the finding that in early pregnancy, when prenatal diagnosis is most desirable, expression is as high as 95% suggests that the transferrin receptor may be a suitable antigen for separation of fetal from maternal blood mononuclear cells for the purpose of genetic prenatal diagnosis.

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