

Predictive value of cord blood IgE levels in 'at-risk' newborn babies and influence of type of feeding

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Summary

Cord serum IgE levels were examined in 101 newborn infants of atopic parents, and reviewed at the ages of 3, 6, 9, 12, 15, 18, 21 and 24 months, in order to determine any relation with signs and symptoms of allergic rhinitis, bronchial asthma, atopic dermatitis, urticaria and food allergy.

Cord blood IgE levels were 1.06 ± 1.02 U/ml in the group of infants who developed atopic disease, and 0.34 ± 0.79 U/ml in the group of infants who did not develop atopy ($P < 0.001$).

In the breast-fed group 37.5% of the infants with cord blood IgE more than 0.8 U/ml and 11.5% with IgE below 0.8 U/ml had atopic disease. In the soy-fed group 33.3% of the infants with cord blood IgE more than 0.8 U/ml and 15.8% with cord blood IgE less than 0.8 U/ml developed atopy. Ninety percent of the cow's milk-fed infants with cord blood IgE above 0.8 U/ml and 16% with cord blood IgE below 0.8 U/ml showed atopy during the follow-up period.

No correlation was found between the IgE levels in maternal and respective cord blood.

Introduction

Epidemiologic and clinical studies firmly support an association between the likelihood to form IgE antibody and susceptibility to atopic disease: bronchial asthma, seasonal and perennial allergic rhinitis and atopic dermatitis.

In the last 10 years, several studies in healthy children have correlated the predictive value of high IgE levels with the future development of atopy (Hamburger *et al.*, 1974; Kjellman, 1976; Dannaeus, Johansson & Foucard, 1978). In addition, it has been shown that children with wheezy bronchitis and increased amounts of IgE develop asthma more often than children with normal amounts (Foucard, 1974; Businco *et al.*, 1979). It appears that increased amounts of IgE in healthy children are highly

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indicative of subsequent development of atopic disease, and reaginic sensitization can occur for a varying period before onset of allergic symptoms (Chambers, Alto & Glaser, 1958). This period has been defined as 'pre-clinical stage of atopy' (Serafini & Bonini, 1979).

The assay of cord blood IgE levels by the PRIST® technique has been shown to provide reliable data for predicting future atopic disease in newborn infants (Kjellman & Johansson, 1976; Dannaeus *et al.*, 1978; Michel *et al.*, 1980).

Many factors, genetic and environmental, appear to contribute to the development of atopic disease. Dietary control in the first months of life as a prophylaxis for atopy have provided encouraging results in prospective studies (Johnstone & Dutton, 1966; Matthew *et al.*, 1977; Saarinen *et al.*, 1979) and IgE determination in cord blood might be a useful tool to select 'at-risk' infants.

The aim of the present study was to evaluate the predictive value of IgE concentrations in cord blood of newborn infants 'at risk' for atopy, and to investigate the influence of three different types of feeding; breast, soy, and cow's milk, on the predictive value of cord blood IgE levels.

Materials and methods

One hundred-and-one newborn babies with a family history (parents or siblings) of atopic disease (asthma, rhinitis, atopic dermatitis) were selected. All the infants were born at the San Giovanni Hospital in Rome and the parents gave informed consent to participate in the study.

The mothers were encouraged to breast-feed exclusively for at least 6 months. These breast-feeding mothers drank no more than 200 ml of milk daily and ate no more than two eggs weekly. When the mothers were unable to continue to breast-feed after the first 2 weeks, the infants received soy milk (Similac-Isomil, Abbott) but when they could not breast-feed from birth or from the first 2 weeks, cow's milk formula was given.

In the breast and soy milk-fed infants, no solid food was given for the first 6 months and selected foods only were permitted up to 9 months (lamb, rabbit and pork meat, rice, olive oil, fruit and vegetables). In the cow's milk-fed infants, no attempt was made to influence the type and the time when solid food was given.

All the infants were seen at a special clinic at the ages of 3, 6, 9, 12, 15, 18, 21 and 24 months when a detailed history was taken, and the presence of clinical symptoms and signs of allergic rhinitis, bronchial asthma, atopic dermatitis, allergic urticaria and gastro-intestinal allergy were evaluated. In addition, the mothers contacted us when the infants were sick; thus we could check all illnesses in the test group.

Thirty-four newborn babies were breast-fed exclusively until 6 months of age, twenty-six received soy milk supplemented with partial breast-feeding on an average of 1.5 months, forty-one received cow's milk formula from birth and eleven of them were also partially breast-fed for an average of 2 weeks.

Cord blood was collected immediately after the birth by direct needle aspiration of the cord vein, and maternal blood was collected within 1 h following birth. Sera were stored at -20°C until examined.

Serum IgE was assayed by Phadebas IgE PRIST® (Pharmacia Diagnostics AB, Uppsala, Sweden). IgE below 0.5 U/ml was considered as undetectable and in the statistical analysis, undetectable amounts of IgE were assumed to be 0.

Cow's milk-specific IgE antibodies were detected by Phadebas RAST® (Pharmacia

Diagnostics AB, Uppsala, Sweden). The test was considered positive when the sample contained at least 0.35 PRU/ml of specific IgE.

The values of IgE in the cord blood of newborn babies with subsequent atopic disease were compared with the values of those without atopic disease using the Student's *t*-test.

Results

Cord blood IgE levels ranged from 0–4.2 U/ml, mean 0.53 ± 0.9 U/ml. IgE was undetectable (<0.5 U/ml) in 57% of the newborn babies (Fig. 1).

Six of thirty-four breast-fed, 5/25 soy-fed and 15/41 cow's milk-fed infants developed atopic disease during the 2-year follow-up.

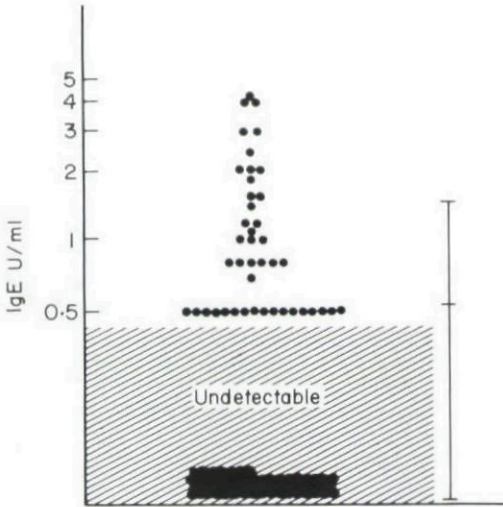


Fig. 1. Cord blood IgE in 100 newborns of atopic parents.

Cord blood IgE concentrations were 1.06 ± 1.02 U/ml in the group of infants who developed atopic disease, and 0.34 ± 0.79 U/ml in the group of infants who did not ($P < 0.001$) (Fig. 2).

In the breast-fed group, 37.5% of the infants with cord blood IgE more than 0.8 U/ml and 11.5% with IgE below 0.8 U/ml had atopic disease. In the soy-fed group, 33.3% of the infants with cord blood IgE more than 0.8 U/ml and 15.8% with cord blood IgE less than 0.8 U/ml developed atopy. Ninety percent of the cow's milk-fed infants with cord blood IgE above 0.8 U/ml showed atopy during the follow-up period.

The serum IgE levels in the atopic mothers were 272 ± 280 U/ml and 0.68 ± 1.2 U/ml in the cord blood of their newborn babies. The serum IgE levels in the non-atopic mothers were 41 ± 31 U/ml and 0.62 ± 1.03 U/ml in the cord blood of their newborn babies. No correlation was found between the IgE levels in maternal and respective cord blood (Fig. 3).

Specific IgE antibodies to cow's milk proteins were present in only one cord blood. In contrast, the mother of this newborn infant had no specific IgE antibodies to cow's

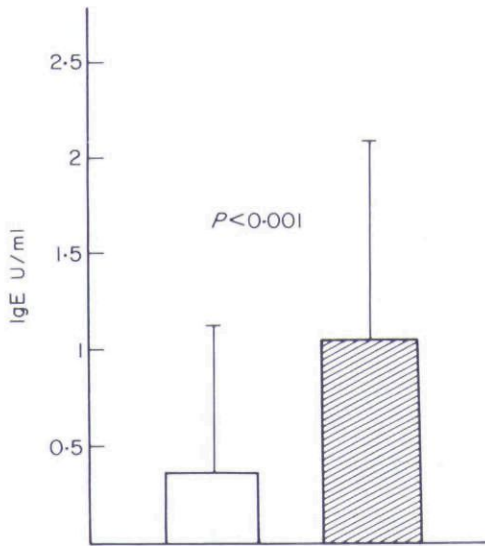


Fig. 2. Cord blood IgE in 100 'at-risk' newborns followed up to 2 years: No. 26 with atopic diseases ■ and No. 74 without atopic diseases □.

milk. This infant vomited and had diarrhoea and asthma when cow's milk formula was first given at the age of 20 days.

Only one newborn baby had cord blood IgE above 5 U/ml namely 10 U/ml and during the follow-up, IgE increased up to 56 U/ml. This infant was soy-fed and showed cow's milk allergy at the age of 1 year. Due to the large amount of IgE in his cord blood, this result was not included in the statistical analysis.

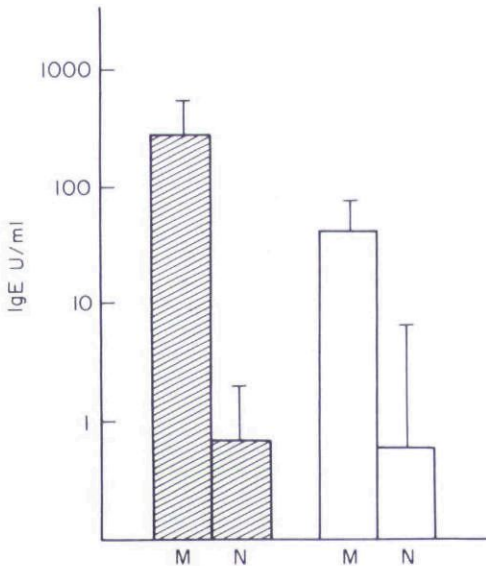


Fig. 3. Serum IgE in atopic ■ and non-atopic □ mothers (M) and in their newborns (N).

Discussion

The results indicate that the measurement of IgE antibody in cord blood by the PRIST seems to be a helpful diagnostic aid to an early diagnosis of atopy. Cord blood IgE levels were 1.06 ± 1.02 U/ml in the newborn babies who develop atopy, and 0.34 ± 0.79 U/ml in those who did not show any atopic manifestations during the 2-year follow-up ($P < 0.001$). Our data suggest that atopy in babies with large amounts of IgE in the cord blood can be influenced by the type of feeding during the first months of life. Ninety percent of the cow's milk-fed infants with cord blood IgE more than 0.8 U/ml showed atopic manifestations, whereas only 33.3% of the soy milk-fed and 37.5% of the breast-fed infants with cord blood IgE above 0.8 U/ml developed atopy. These data suggest that environmental manipulations such as the type of feeding in the first months of life can prevent the development of atopic disease in infants 'at risk', not only on the basis of family history but for the amount of cord blood IgE too (Businco *et al.*, 1982).

Our study confirms that prolonged breast-feeding is effective in preventing atopy in 'at-risk' infants and breast-feeding supplemented by soy milk for the first 6 months also reduced the incidence of atopy. The dietary avoidance regimen of the nursing mothers as well as the selected first solid foods for the babies, permitted only after the sixth month, could have enhanced the preventive effect of breast-feeding and soy milk.

Only one newborn baby had cow's milk-specific IgE antibodies, and the absence of such antibodies in the mother is in favour of an intrauterine sensitization. In addition, this infant showed asthma, vomiting and diarrhoea when cow's milk formula was introduced into his diet at the age of 20 days, indicating that IgE antibodies, synthesized by the fetus, can be responsible for atopic disease in early infancy.

Other studies have showed the presence of reaginic antibodies in newborn babies and support the contention of intrauterine sensitization (Matsumura, Takayoshi Kuronne Oguri & Iwasaki, 1975; Foucard, 1974; Michel *et al.*, 1980). Synthesis of IgE in the human fetus has been detected as early as the eleventh week of gestation in fetal lung and in liver (Miller, Hirvonett & Gitlin, 1973; Singer, Hobel & Heiner, 1974). 1974).

In conclusion, cord total IgE determination using the PRIST technique appears to be a simple, economical and reliable method for early diagnosis of atopy. We suggest, as proposed by other authors (Kjellman, 1976; Michel *et al.*, 1980), that total IgE should be determined in all newborn babies at risk for atopy.

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