BRAIN BIOCHEMISTRY AND INTRAUTERINE GROWTH

Certain biochemical measures of brain growth are altered in children who have failed to grow normally in utero.

KEY WORDS: intrauterine underdevelopment, cerebellar weight, cerebroside, sulfatide, brain growth

Intrauterine growth retardation resulting in small-for-gestational-age (SGA) infants occurs by definition in 10 percent of all term pregnancies,[1] and is more common in infants of mothers from low socioeconomic environments.[2] The causes of intrauterine growth retardation are numerous and frequently poorly understood, but often fall into one or more of three categories: placental insufficiency, intrauterine infections, and congenital malformations. Between 30 and 50 percent of term SGA infants who survive eventually demonstrate impaired neurologic and intellectual development.[3] A previous study has shown reduced amounts of DNA, protein, and myelin lipids in brains from newborn guinea pigs following intrauterine undernutrition.[4] In rats, intrauterine undernutrition secondary to a maternal low protein diet or to uterine vasculature ligatures has also been shown to result in reduced newborn body weight,[5,6] brain weight, and brain DNA.[7,8] However, the periods of brain development,[4] and the experimental conditions are very different in animal studies as compared with studies on human beings.

In a study by H. P. Chase et al.[9] analyses of brains from six infants whose birth weights were SGA and ten infants whose birth weights were "appropriate for gestational age" (AGA) show the cerebellum to be the area of the brain most greatly affected by intrauterine underdevelopment. The SGA cerebellar weight was reduced 37 percent and cellularity 35 percent, compared with reductions of only 21 percent and 19 percent for weight and cellularity in the remainder of the brain. The myelin lipids, cerebroside and sulfatide, were significantly reduced ($p < 0.01$) in concentration or total quantity in the brains of SGA infants, in contrast to phospholipids, cholesterol, and gangliosides which did not show a similar reduction. Galactolipid sulfotransferase activity, important in sulfatide formation, was also significantly reduced ($p < 0.01$) in the brains from SGA infants.

The authors speculate that the infant with low birth weight for gestational age has brain biochemical alterations, particularly of the cerebellum, and of the myelin lipids cerebroside and sulfatide. In spite of these alterations, the periods of postnatal brain development are such that most, if not all, deficits might be corrected with optimal postnatal rehabilitation. In contrast, further postnatal insults might prevent recovery, and result in further reductions in brain biochemical composition.

Thus it would appear that the human infant may show changes in his brain secondary to fetal malnutrition similar to the changes previously described in rat fetuses. More data are necessary but the burden of proof seems to have shifted to those who claim that the human infant is totally protected from the nutritional status of the mother. □

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