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The predictive value of glucose utilization rate in neonatal hypoglycaemia of small-for-gestational-age infants

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The glucose utilization constant K was determined in 50 small-for-gestational-age neonates. In 11 cases the K value was higher than 2.0, and 5 out of these babies developed asymptomatic hypoglycaemia. In 39 infants the K value was under 2.0, and except in one false negative instance, no hypoglycaemia was observed. The results suggest that early determination of the glucose disappearance rate is useful in predicting the probability of hypoglycaemia.

Neonatal hypoglycaemia is common in small-for-gestational-age (SGA) babies [13, 19]. While the potential dangers associated with symptomatic hypoglycaemia are universally accepted, the clinical significance of the asymptomatic form is a controversial problem. Most authors claim that asymptomatic hypoglycaemia does not cause cerebral damage, and hence does not require correction by intravenous glucose infusion [2, 5, 7, 9]. Since, however, symptomatic hypoglycaemia is often preceded by an asymptomatic phase, it is important to detect it in the early neonatal period before neurological symptoms would develop. Early detection as a preventive measure is particularly useful if it is combined with the determination of glucose disappearance rate [7, 12]. In contrast to asymptomatic hypoglycaemia, the symptomatic form is often associated with increased peripheral glucose utilization. Thus, knowledge of the utilization constant may help in differentiating between the two types of hypoglycaemia, and in predicting the risk of developing clinical symptoms. Mestyán [14] has in fact observed infants with asymptomatic hypoglycaemia and increased glucose utilization, who developed neurological symptoms a few hours later.

In view of these data we have studied the glucose utilization constant in hypoglycaemic small-for-dates newborns.

Materials and Methods

Altogether 50 small-for-dates infants were examined within the first 6 hours of extrauterine life. Fig. 1 shows their distri-

bution on a Hungarian intrauterine growth chart [6].

As it is seen, the majority of the infants exhibited a marked weight deficit. Those scattered around the 10th percentile curve were also clinically wasted. Except malnutrition, no pathological signs were observed.

The intravenous glucose tolerance test was performed as follows. After taking blood for determination of the pretest glucose level, a 20% glucose solution was injected into a peripheral vein in a dose of 1 g per kg body weight. Blood samples were taken at the 20th, 30th and 40th minutes, and glucose was determined by the orthotoluidine method [16]. The glucose disappearance rate (K value) was calculated according to Amatuzio et al. [1] by the formula $K = \frac{0.693 \times 100}{t\ 1/2}$, where t 1/2 was obtained from the semilogarithmic plot of blood glucose by the graphical method.

The infants were normally fed with breast milk from the 8th hour. Blood sugar concentration was controlled at 3 to 4 hour intervals for two days.

Results

Results are demonstrated in Fig. 2, where the individual K values are plotted against the lowest blood glucose values of the babies.

In 11 out of 50 neonates, the K value was higher than 2.0, indicating an increased glucose utilization. Since five of these babies received a glucose infusion because of the high utilization constant, only six were followed with respect to the behaviour of blood glucose level. In five infants hypoglycaemia developed in spite of early oral feeding.

In 39 babies the K value was under 2.0, and except for one false negative case, no hypoglycaemia was observed.

Table I demonstrates the absolute and relative frequency of normo- and hypoglycaemia among the newborns whose glucose utilization constant was higher or lower than 2.0.

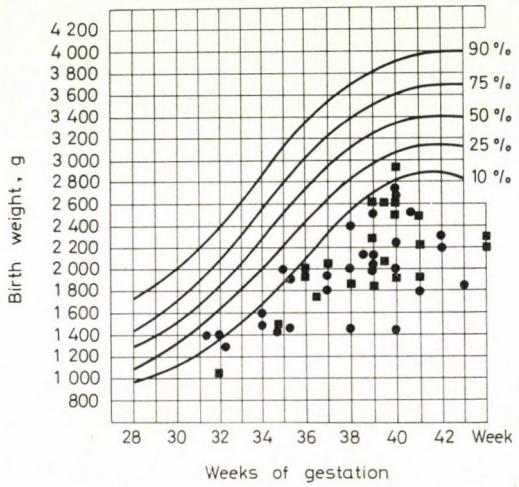

Fig. 1. Birth weight and gestational age of 50 newborns

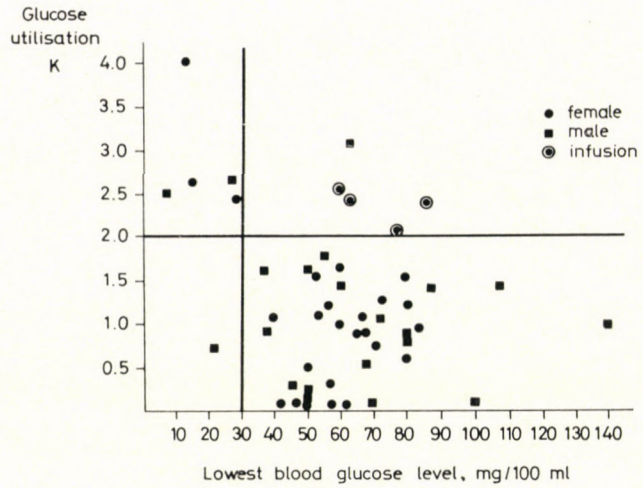

FIG. 2. Individual glucose utilization constant (K) values plotted against the lowest blood glucose levels observed

TABLE I

Probability of normo- and hypoglycaemia according to K values above or under 2.0

		Probability of	
		normoglycaemia	hypoglycaemia
K	<2.0	39/40 97.5%	1/40 2.5%
K	⩾2.0	1/6 17%	5/6 83%

DISCUSSION

The significance of asymptomatic hypoglycaemia has not been clarified definitely. At follow-up examinations both completely normal development [2, 3, 5, 7, 9] and permanent abnormalities of the central nervous system [4, 8, 17] were found in patients with previous neonatal asymptomatic hypoglycaemia. According to MESTYÁN [13] and MARTIN [11] there are as yet no means of distinguishing at an early stage those cases of hypoglycaemia that will become symptomatic, nor those that develop neurological sequelae. Moreover, the discovery of symptoms, particularly of transient ones, would require continuous close observation of the neonate, which is impracticable in most neonatal units. Thus, it is desirable that all cases of hypoglycaemia be treated or, when possible, prevented.

The question whether the glucose utilization constant is useful in predicting hypoglycaemia, is still debated. The fast clearance of glucose in small-for-dates newborns with symptomatic hypoglycaemia seems to be well established [7, 10, 15, 18]. No such cases were seen in the present material. According to the observation of GENTZ' et al. [7],

asymptomatic hypoglycaemia is associated with a low glucose disappearance rate. SOLTÉSZ et al. [18] and LE DUNE et al. [10] essentially confirmed this finding, but in a few instances the K value was higher than normal in the early neonatal period. In the present study, 6 out of 50 infants showed hypoglycaemia, and in 5 of them the intravenous tolerance test revealed an increased peripheral glucose utilization (K = 2.0).

From our results the predictive value of the glucose utilization rate with respect to the probability of subsequent hypoglycaemia is quite obvious (Table I); K values above 2.0 indicate a high risk of developing critically low blood glucose levels.

Early detection and early treatment of hypoglycaemia probably explains why in the present material all of the affected infants were symptomless. Based on MESTYÁN's [14] observations it is not unrealistic to assume that, without treatment, some of the infants would have developed symptoms. The present observations confirm the idea that knowledge of the glucose utilization constant derived from the intravenous tolerance test is not only helpful in preventing a glucose deficiency, but also offers information concerning the mechanism of the impaired blood glucose homeostasis.

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