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Cardiomegaly in hypoglycaemic small-for-gestational-age infants

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The chest X-rays of 15 hypoglycaemic small-for-gestational-age infants showed cardiomegaly in 10 infants, 4 had heart failure. None of the infants had respiratory distress syndrome, congenital heart disease, septicaemia, anaemia or polycythaemia; infants of diabetic mothers were excluded. Cardiomegaly disappeared with the normalization of blood glucose in most of the cases. The cause of the cardiomegaly and heart failure might be related to insufficient cardiac energy substrates in small-for-gestational-age infants. This condition should also be considered in the differential diagnosis of cardiomegaly and heart failure.

Hypoglycaemia is frequent in small-for-gestational-age (SGA) infants in the immediate postnatal period. The majority of its symptoms is related to the central nervous system [4, 11]. There have been few reports on the effects of hypoglycaemia manifesting with cardiomegaly and heart failure [1, 7, 8, 14]. These observations were made mainly in SGA infants.

A retrospective study of the chest X-rays of hypoglycaemic SGA infants admitted to our neonatal ward has therefore been performed.

Material and Method

During the five year period from January 1975, to December 1979, 32 hypoglycaemic SGA infants were admitted to our intensive care unit. Hypoglycaemia was diagnosed when the blood sugar was less than 20 mg/dl in preterm and less then 30 mg/dl in term infants. In 15 infants chest radiography was done at the onset of hypoglycaemia. Birthweight of these infants was below the tenth percentile according to our local intrauterine growth chart and they showed the typical signs of intrauterine malnutrition. Mean birthweight and gestational age of the infants are shown in Table I.

Table I

Birth weight and gestational age of the infants studied (Means and ranges)

Gestational age, week	38.8	(36–42)
Birth weight, g	2077	(1750–2650)
No. of infants	15	

Chest Y-rays were made in supine position antero-posteriorly. The transverse diameter of the chest and heart was measured as described earlier [12]. The cardiothoracic ratio was also calculated. Heart

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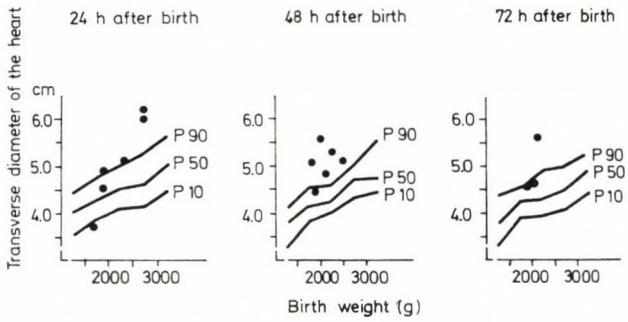

FIG. 1. Percentile position of heart size (transverse diameter of the heart) in 15 SGA infants with hypoglycaemia, according to our local standard

failure was diagnosed on the basis of the following symptoms: dyspnoea and tachypnoea (respiratory rate > 50/min); radiographic evidence of heart enlargement and pulmonary congestion; hepatomegaly. Heart enlargement was diagnosed when the transverse diameter was above the 90th percentile of our local standard and the cardio-thoracic ratio was greater than 0.52 (normal mean 0.50 ± 0.02). None of the infants had respiratory distress syndrome, congenital heart disease, septicaemia, anaemia or polycythaemia, conditions which may be associated with cardiac enlargement.

RESULTS

Ten of the 15 hypoglycaemic infants had cardiomegaly based on chest radiographs taken within three days postnatally, when hypoglycaemia had developed. The transverse diameter of the heart was above the 90th percentile [12]. We use different standards for each day of early postnatal life in view of the physiological changes in heart size after birth (Fig. 1). The cardiothoracic index ranged between 0.52–0.60.

TABLE II

Clinical data and radiographic findings in 10 small-for-gestational-age infants with hypoglycaemia and cardiac enlargement

No.	Birth weight, g	Gestational age, week	Labour and delivery	Apgar score 1 min	Apgar score 5 min	Blood glucose, mg/dl	Cardiothoracic index	Heart failure	Age at onset of hypoglycaemia, day
1	2650	42	normal	10	10	6	0.55	+	1
2	2200	39	vacuum extractiom	4	8	4	0.60	+	1
3	1750	—	toxaemia	10	10	12	0.52	—	1
4	2300	—	cord around the neck	4	8	29	0.53	—	1
5	2020	36	normal	9	10	24	0.60	+	2
6	2330	37	toxaemia	9	10	17	0.54	—	2
7	2140	38	normal	10	10	18	0.56	—	2
8	2450	40	cesarean section	6	10	30	0.52	—	2
9	1840	—	normal	7	8	20	0.56	—	2
10	2170	40	normal	8	10	25	0.58	+	3

The clinical data and the radiographic findings of the 10 SGA infants with cardiomegaly are summarized in Table II. Four infants with cardiomegaly had symptoms suggestive of congestive heart failure (Cases 1, 2, 5 and 10) manifesting with tachypnoea, tachycardia and hepatomegaly. These infants required a short period of digitalis therapy. In all infants the hypoglycaemia was treated with 5–10% dextrose infusion. The infants, who had cardiomegaly without heart failure improved rapidly, and showed a normal heart size after correction of the hypoglycaemia.

The course of one of the infants is shown in Figure 2, at 2 days of age showing enlarged heart, and at 5 days of age showing a normal heart. Of those with cardiac failure 1 infant improved rapidly, in the other 3 infants the cardiomegaly persisted for

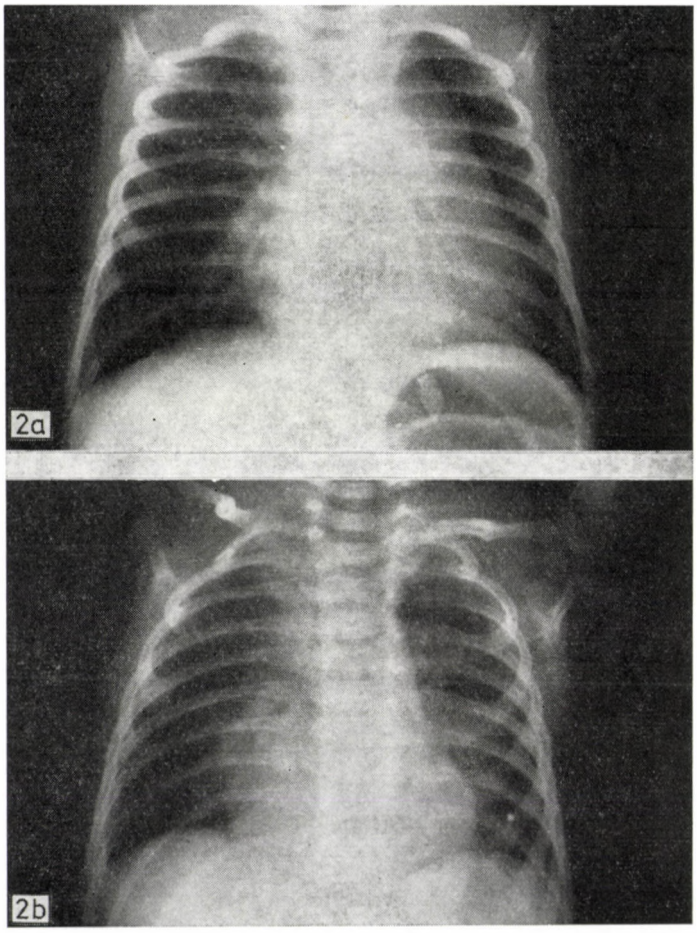

FIG. 2. Chest X-rays of SGA infant with hypoglycaemia and cardiomegaly. *a*) At 2 days of age showing enlarged heart; *b*) at 5 days of age showing normal heart

7–21 days. All four patients with cardiac failure had repeated ECG-s, which were abnormal showing peaked P waves in lead I, wide QRS complex, long QT interval. None of the hypoglycaemic SGA infants died.

Discussion

As to the association of hypoglycaemia and heart enlargement in the newborn infant, Benzing et al [2] described 27 infants with heart failure and hypoglycaemia; 26 had severe heart malformations. Reilly et al [8] were the first to report on the association of heart failure and neonatal hypoglycaemia in infants without cardiac malformations. Wyler et al [14] comparing the chest X-rays of 24 hypoglycaemic newborns with those of a matched control group of infants with normal blood glucose levels, found that heart size was significantly greater in the hypoglycaemic than in the control group. A retrospective review [1] of chest X-rays of 16 infants showed cardiomegaly in 12 infants; 6 of them were SGA. McReid et al [8] found 6 small-for-date babies with hypoglycaemia; they all had radiographic heart enlargement. Infants of diabetic mothers, infants with cardiac malformations and with polycythaemia were excluded from the studies.

Cardiac enlargement not due to congenital heart disease or maternal diabetes may occur in the newborn infant after perinatal asphyxia [3, 13], haemolytic disease [6], or polycythaemia [5]. Yao et al [15] demonstrated that small-for-date infants may have increased blood, red cell and plasma volumes.

Asphyxia may have been responsible for the cardiomegaly in three of our patients whose one minute Apgar score was less than 7, but not in the rest. The haematocrit value was within normal limits, therefore polycythaemia or anaemia was not a factor in the development of heart enlargement.

Since cardiomegaly mostly disappeared with the normalization of the blood glucose level, the cause of heart failure may be related to insufficient cardiac energy substrates. The small-for-date infant has low carbohydrate stores in the liver and heart [9, 10], which are rapidly depleted after birth, especially during hypoxic episodes [10]. Deprivation of cardiac glycogen might result therefore in functional insufficiency.

On the basis of our findings, hypoglycaemia should be considered in the differential diagnosis of cardiomegaly and heart failure in newborn infants.

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