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SHOULD AN ECHOCARDIOGRAPHIC SCAN BE DONE ROUTINELY FOR INFANTS OF DIABETIC MOTHERS?*

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SUMMARY: Vural M, Leke L, Mahomedaly H, Maingourd Y, Kremp O, Risbourg B. (2nd Service of Pediatrics and Pediatric Cardiology Unit, Picardie Jules Verne University Faculty of Medicine, Amiens, France). Should an echocardiographic scan be done routinely for infants of diabetic mothers? Turk J Pediatr 1995; 37: 351-356.

Several cardiologic pathologies are seen in infants of diabetic mothers (IDMs). Though asymmetrical septal hypertrophy (ASH) is a frequent pathology in IDMs, it is not routinely searched for with an echocardiographic scan. We have performed an echocardiographic examination for all IDMs (56 neonates) hospitalized between January 1987 and December 1992 in our neonatology and neonatal reanimation units. Of 56 patients, the diagnosis of 17 cases of ASH (30%) was made. The group with ASH (17 neonates) had a greater corporeal index than the group without ASH (39 neonates) ($p < 0.05$). Four of the 17 IDMs (24%) with ASH and one of the 39 IDMs (3%) without ASH presented with a cardiac insufficiency ($p < 0.05$). ASH is a pathology which should be searched for routinely in IDMs. *Key words: infants of diabetic mothers, asymmetrical septal hypertrophy, diabetes mellitus, echocardiography.*

It is well known today that infants of diabetic mothers (IDMs) may present with many complications including macrosomia, poor intrauterine growth, organomegaly, hypocalcemia, hypoglycemia, hypomagnesemia, respiratory distress syndrome, hyperbilirubinemia and congenital malformations in the neonatal period[1-3]. Two types of cardiac pathologies are commonly observed in these infants: cardiac malformations and asymmetrical septal hypertrophy. Asymmetrical septal hypertrophy (ASH), a pathology often ignored in IDMs, was wirst described by Poland et al.[4] and then by Gutgesell et al.[5]

The purpose of this study was to determine the ASH frequency in IDMs and to examine the necessity of performing echocardiographic scan routinely.

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Material and Methods

Fifty-six IDMs hospitalized between January 1987 and December 1992 in the neonatology and neonatal reanimation units of the University Hospital (Amiens, France) were studied. An echocardiographic scan was done routinely regardless of cardiac or respiratory distress syndromes in the first 72 hours of life.

All echocardiograms were obtained with a Hewlett Packard 1000 SONO echograph with a 5 mhz transducer. End diastolic interventricular septal thickness was measured in M-mode at the third or fourth intercostal space and the left sternal border. We paid close attention to differentiating the posterior tricuspid valve leaflet from the ventricular septal endocardium. Septal hypertrophy is defined as +2 standard deviations compared to the gestational age of our reference population.

Infants presenting with blood sugar of less than 2 mmol/L in the total blood specimen were considered hypoglycemic. Bilirubinemia is defined as a serum bilirubin concentration of greater than 150 micromol/L, polycythemia as hematocrit of greater than 60 percent and hypocalcemia as serum calcium concentration of less than 1.75 mmol/L.

The results are expressed as a mean ± standard deviation, and Chi-square test was used for statistical calculations.

Results

Sixteen of 56 mothers had insulin-dependent diabetes mellitus, 37 had non-insulin-dependent diabetes and three had gestational diabetes. Summarized characteristics of our infant population with or without ASH are presented in Table I. The gestational age ranged from 32 to 42 weeks (mean 37.7 ± 2.3) and the birthweight from 1200 to 4970 g (mean 3628 ± 890). Sixteen of 56 infants (29%) were large for gestational age, two (4%) were small for gestational age and 38 (68%) were appropriate for gestational age.

Table I: Characteristics of Our Population, Grouped According to Presence or Absence of ASH

	without ASH (n = 39)	with ASH (n = 17)	p
Gestational age (weeks)	37.5 ± 2.4	37.5 ± 2.3	non significant
Birthweight (g)	3585 ± 920	3842 ± 804	non significant
Birth length (cm)	50 ± 4.1	51 ± 2.4	non significant
Corporeal index	2.79 ± 0.31	3.02 ± 0.23	< 0.05

The diagnosis of 17 cases of ASH was made out of 56 infants (30%) with a routine echocardiographic scan. No cardiac malformation or systolic anterior movement (SAM) was diagnosed.

Of the 56 IDMs, 36 (64%) presented with hypoglycemia and 11 (20%) presented with hypocalcemia, all of which resolved after supplementations. Fourteen (25%) were polycythemic and 34 (61%) were icteric. Fifteen (nine without ASH, six with ASH) of the neonates showed symptoms of respiratory distress syndrome, which led in six (three without ASH, three with ASH) cases to the need for mechanical ventilation (Table II).

Table II: Complications and Their Relations with Presence or Absence of Asymmetric Septal Hypertrophy

	without ASH (n = 39)	with ASH (n = 17)	p
Hypoglycemia	26 (67%)	10 (59%)	non significant
Hyperbilirubinemia	24 (62%)	10 (59%)	non significant
Polycythemia	11 (28%)	3 (17%)	non significant
Respiratory distress syndrome	9 (23%)	6 (35%)	non significant
Hypocalcemia	8 (21%)	3 (18%)	non significant
Cardiac insufficiency	1 (3%)	4 (24%)	< 0.05

Five of the infants required antidiuretic treatment because of cardiac insufficiency. Four of them were in the ASH group and only one did not have cardiomyopathy.

Discussion

The frequency of ASH in this study was 30 percent (17/56). Trowitzsch et al.[6] found ASH in 35 percent of their population of 30 IDMs, and Fenichel et al.[2] discovered 14 cases of ASH in 44 macrosomic IDMs (31%). Lusson et al.[7] reported six cases of this type of cardiomyopathy in 11 neonates. On the other hand, Erdem et al.[8] did not show any statistical difference in the thickness of the left ventricular posterior wall and the interventricular septum between 31 IDMs and 14 control infants.

In our population, there was no statistical difference between ASH and non-ASH groups for birthweight, length and gestational age. However, infants with ASH had a greater corporeal index than neonates without cardiomyopathy (Table I). It is generally agreed that corporeal index better reflects tissue development than a simple measure of weight or length. Insulin causes an increase not only in cell number but also in cell size of the fetus. The same hormone stimulates an increase in myocardial nuclei, cell number and fiber[9-11]. It is not surprising to find a parallel between interventricular septum thickness and corporeal index augmentation, both influenced by fetal hyperinsulinism (Fig. 1).

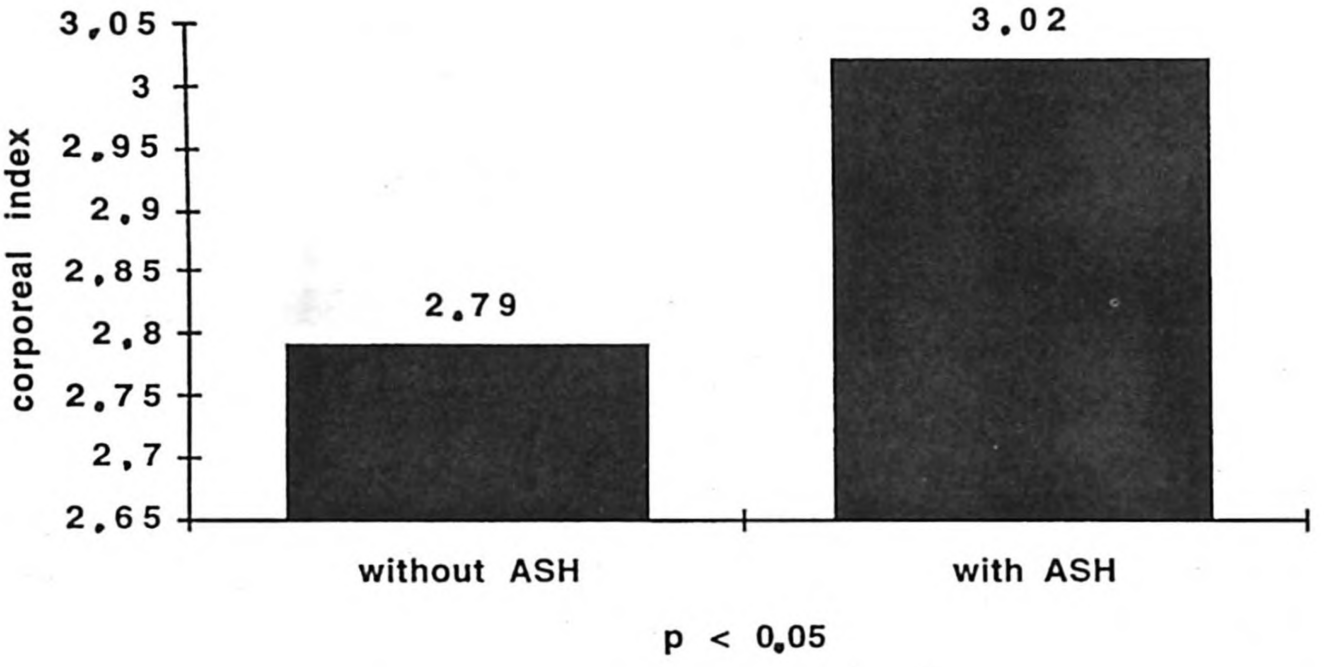

Fig. 1: Mean corporeal values are shown for each group. The difference is statistically significant.

The two groups were not statistically different when compared for bilirubinemia, glycemia, calcemia and hematocrit.

Though other authors found cardiac malformation, we had none in our population. Various studies have examined cardiac pathologies in IDM. Rowland et al.[3] found 19 infants with a congenital heart lesion out of 470 IDMs. Cruveiller[12] and Day[13] found rates of major cardiac malformations to be six percent and 3.6 percent, respectively. The only explanation we can make for the absence of malformation in our population may be better metabolic regulation in the first six to seven weeks of pregnancy.

Another statistically important result of our study was the presence of cardiac insufficiency syndrome in IDMs. This syndrome is seen in 24 percent of neonates presenting with an ASH but in only three percent of neonates without cardiomyopathy. This statistically significant difference shows the importance of an early ASH diagnosis, which may avoid progression towards cardiac insufficiency and sudden infant death syndrome. Diuretics (furosemide) are obligatory, and digoxine is contraindicated in the treatment. All of our neonates in the ASH group (with or without cardiac insufficiency syndrome) were surveyed until the age of six months. Disappearance of cardiomyopathy was observed in all of the 17 infants before six months of age (Fig. 2).

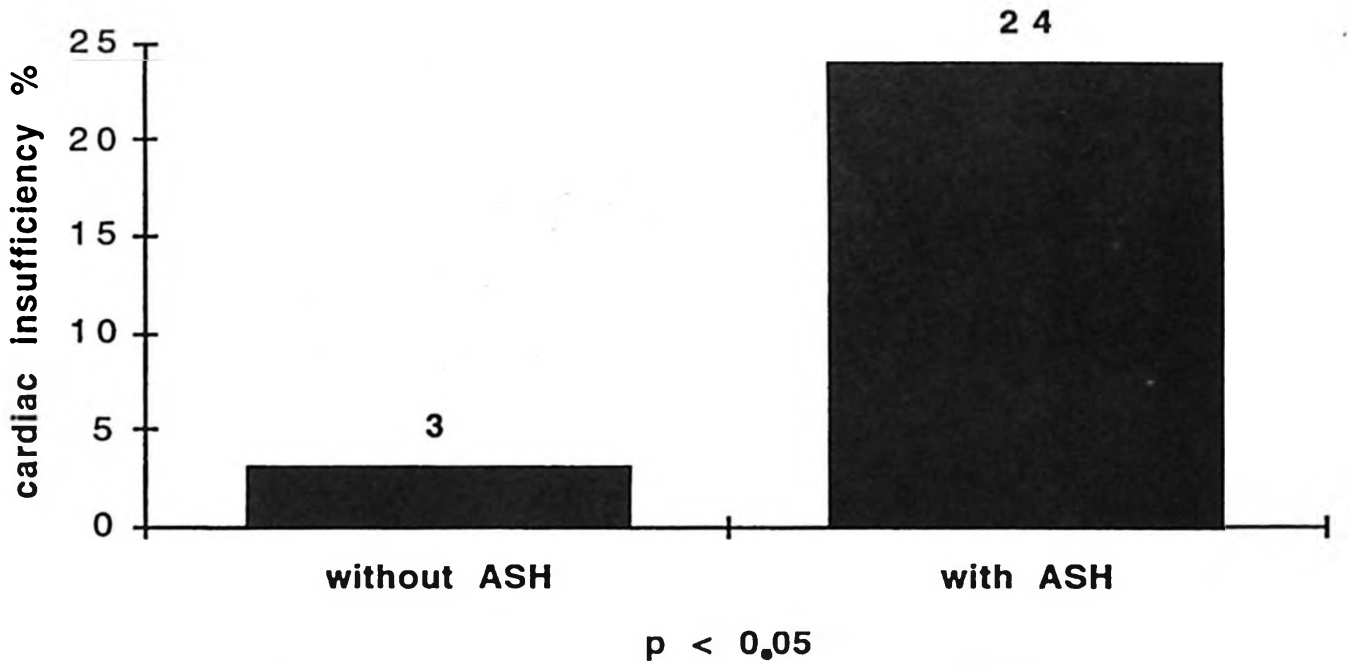

Fig. 2: Presence of cardiac insufficiency in each group.

Respiratory distress syndrome existed in both groups with no statistical difference. Artificial ventilation was indicated in three of four infants presenting with cardiac insuffiency secondary to cardiomyopathy. In the group without cardiomyopathy, artificial ventilation was indicated once secondary to cardiac insufficiency, and twice secondary to hyaline membrane disease.

This study shows the importance of echocardiography for the diagnosis of asymmetric septal hypertrophy (17/56 in our population) in infants of diabetic mothers. The risk of cardiac insufficiency is much more important in IDMs with ASH. ASH is a pathology which should be searched for routinely in each IDM, and its echocardiographic follow-up is obligatory until complete disappearance.

REFERENCES

1. Haumont D. Le nouveau né de mère diabétique. Rev Prat 1983; 7: 369-375.
2. Fenichel P, Hieronimus S, Bourlon F, et al. Macrosomie du du foetus de mère diabétique. Presse Med 1990; 19: 255-258.
3. Rowland TW, Hubbel JP, Nadas AS. Congenital heart disease in infants of diabetic mothers. J Pediatr 1973; 83: 815-820.
4. Poland RL, Walther LJ, Chang C. Hypertrophic cardiomyopathy in infants of diabetic mothers (abstr). Pediatr Res 1975; 9: 269.
5. Gutgesell HP, Mullins CE, Gillette PC, et al. Transient hypertrophic subaortic stenosis in infants of diabetic mothers. J Pediatr 1976; 89: 120-125.
6. Trowitzsch E, Bigalke U, Gisbertz R, Kallfelz HC. Echocardiographic profile of infants of diabetic mothers. Eur J Pediatr 1983; 140: 311-315.
7. Lusson nJR, Gaulme J, Raynaud EJ, Cheynel J. Hypertrophie septale asymétrique du nouveau-né d mère diebétique. Arch Fr Pediatr 1982; 39: 433-436.
8. Erdem G, Yurdakök M, Özkutlu S, Tekinalp G, Saraçlar M. Tedavi edilen diabetik annelerin çocuklarında ekokardiografi bulguları. Çocuk Sağlığı ve Hastalıkları Dergisi 1991; 34: 205-208.

9. Kaplan SA. The insulin receptor. J Pediatr 1984; 104: 327-336.
10. Halliday HL. Hypertrophic cardiomyopathy in infants of poorly controlled diabetic mothers. Arch Dis Child 1981; 56: 258-263.
11. Breitweser JA, Meyer RA, Sperling MA, Tsang RC, Kaplan S. Cardiac septal hypertrophy in hyperinsulinemic infants. J Pediatr 1980; 96: 535-539.
12. Cruveiller J, Veron P, Benichou JE. Embryofoetopathie diabétique. (A propos de cent observations). Ann Pédiat 1977; 24: 827-836.
13. Day RE, Insley J. Maternal diabetes mellitus and congenital malformation. Arch Dis Child 1976; 51: 935-938.