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Glycosylated hemoglobin (HbA_1), glucose tolerance and neonatal outcome in gestational diabetic and non-diabetic mothers

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1 Introduction

High levels of glycosylated hemoglobin (HbA_1) are observed in patients suffering from poorly controlled diabetes mellitus [19]. Measurement of glycosylated hemoglobin has proved to be a valuable clinical tool of long-term diabetes control since it represents an objective and reliable indicator of overall blood glucose concentrations during the previous eight weeks [3, 18].

HbA_1 comprises three main fractions 1a, 1b and 1c. HbA_{1c} is formed through non-enzymatic condensation of a molecule of the aldose sugar glucose with the amino terminal valine of the hemoglobin β-chain, and it is actually the amount of HbA_{1c} in its stable ketoamine form which reflects the integrated glycemia of the previous two months and makes possible the use of HbA_1 measurement as a means of glucose regulation assessment [9].

HbA_{1a} contains hemoglobin adducts of glucose-6-phosphate and fructose-1,6-diphosphate [13], and HbA_{1b} is probably a deamidation product of hemoglobin [10].

The HbA_1 elevation in diabetic blood samples is only related to the HbA_{1c} component, whereas the concentrations of HbA_{1a} and HbA_{1b} do not differ in non-diabetic and diabetic subjects, as CASTAGNOLA et al. [2] demonstrated recently by macrochromatographic fractionation of HbA_1 from non-diabetic and diabetic subjects. The latter evidence implies that HbA_1 assay – without separated measurement of the HbA_{1c} component – is a clinically satisfactory method of glucose regulation monitoring.

HbA_{1c}, as a stable ketoamine is derived by rearrangement from a labile reversible Schiff base adduct [6] whose content depends on short-term blood glucose variations. Once the ketoamine has formed, the condensation product of human adult hemoglobin and glucose remains irreversible during the life span of the red cells [1, 4]. Thus, blood glucose leaves its specific chemical engramme on the hemoglobin molecule.

Non-enzymatic glycosylation does occur also in long half-life proteins other than hemoglobin and can theoretically lead to alterations of their structural and functional properties. These alterations could play a role in the genesis of diabetic complications such as nephropathy, vasculopathy or cataracts.

The main objectives of the present study are to clarify

a) what values of glycosylated hemoglobin are to be encountered in untreated gestational diabetes during late pregnancy and how these values do differ from those in non-diabetic mothers, and

b) whether and to what extent measurements of glycosylated hemoglobin are suitable for the diagnosis or diagnostic exclusion of gestational diabetes. In addition, the neonatal outcome from the gestational diabetics – after appropriate treatment of their metabolic disturbance – is compared with that from the non-diabetic mothers.

Tab. I. Anthropological data on the women examined

	Age (years)	Body weight* prior to last pregnancy (kg)	Body height (cm)
Non-diabetic mothers with normal weight neonates (Group I)	25.8 ± 4.9	59 ± 7	165 ± 7
Non-diabetic mothers with macrosomic neonates (Group II)	26.8 ± 5.7	60 ± 7	165 ± 7
Gestational diabetic women (Group III)	30.8 ± 5.6	68 ± 12	163 ± 7

* Body weight prior to last pregnancy was presented according to the personal statements of the women. – Data presented: $\bar{x}$ ± s.d.

2 Patients, materials and methods

2.1 Subject groups

Determinations of glycosylated hemoglobin were done in 153 women:

Group I: 69 non-diabetic mothers who were delivered of normal weight infants at term.

Group II: 33 non-diabetic mothers who were delivered of macrosomic infants at term.

Group III: 51 gestational diabetics in the 3rd trimester before the onset of the diabetes therapy.

Table I shows some anthropological data on the women examined. It should be noted that the gestational diabetics (Group III) were on the average 4 to 5 years older and 8 to 9 kg heavier than the non-diabetic women. In this group, one out of five suffered from obesity, i.e. an overweight of at least 20% above normal. In contrast, in the non-diabetics examined (Group I and II), only 4% were obese prior to and during pregnancy. Normal birthweight of the infants was defined as being between the 10th and 90th percentiles for gestational age according to the birthweight curves of NICKL [15] which describe the relative frequency of birthweight by week of gestation for the German population. The macrosomic infants had a birthweight above the 90th percentile and almost all of them weighed more than 4000 g.

2.2 Oral glucose tolerance test

The assessment of glucose regulation was done during the 3rd trimester by means of the oral glucose tolerance test (OGTT, 100 g). The tests commenced at 8 o'clock in the morning after overnight fasting. The glucose concentration was measured in the plasma of capillary blood using a glucose oxidase method in a Glucose Analyzer II, Beckman. To differentiate the non-diabetic cases from the gestational diabetic cases, the blood glucose criteria of O'SULLIVAN and MAHAN [17] were applied; they were modified for the enzymatic glucose assay in capillary plasma. A patient was diagnosed as diabetic if at least two glucose values exceeded the following limits: 0 hours 100 mg/100 ml, 1 hour 190 mg/100 ml, 2 hours 170 mg/100 ml.

Figure 1 gives an overall representation of the plasma glucose levels measured during oral glucose tolerance test in our 3 subject groups.

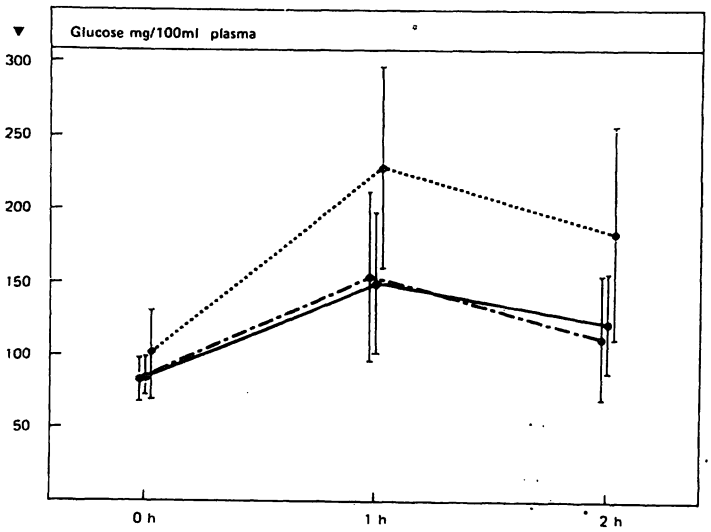

Fig. 1. Glucose levels during oral glucose tolerance test (100 g). – Glucose concentrations were measured in plasma of capillary blood by means of a glucose oxidase method. Data presented: $\bar{x}$ ± 2 s.d.
Group I: continuous line; Group II: broken line; Group III: dotted line.

2.3 Samples

For glycosylated hemoglobin assay, venous blood anticoagulated with EDTA was used. Blood was withdrawn early in the morning after overnight fasting. In Groups I and II sample collection was done on the first or second day after delivery, in Group III at the latest 4 weeks prior to delivery and before onset of the diabetes therapy. If not freshly processed, the samples were stored in a refrigerator at 2 to 4 °C. All samples were processed within 48 hours after withdrawal.

2.4 Assay of glycosylated hemoglobin (HbA_1)

Glycosylated hemoglobin was determined by cation-exchange chromatography in small disposable columns, 0.9 x 10 cms. (BOEHRINGER, Mannheim). We chromatographed the hemolysates of unwashed erythrocytes on the ion-exchange resin (Biorex 70 or Amberlite IRC 50, 1 g per column) equilibrated with phosphate buffer, 40 mmol/L, pH 6.7. After elution with the phosphate buffer of the "fast" chromatographic fraction (HbA_1), we compared the absorbance at 415 nm of the fast fraction with the absorbance of the second fraction – containing the "other", i.e. non-glycosylated hemoglobin, which was eluted by a sodium chloride solution, 400 mmol/L. Applying a simple mathematical equation, from the absorbances of the two chromatographic fractions the percentage of glycosylated hemoglobin in relation to total hemoglobin could be easily calculated.

All chromatographies were made at a regulated room temperature of 23 °C. Samples and solutions used were equilibrated at this temperature prior to chromatography. In addition the column temperature was stabilized with a temperature-controlled water jacket at 23 °C.

To ensure the validity of the results, in each chromatographic set of unknown samples a commercial control hemolysate with known content of glycosylated hemoglobin ("HbA_1 Control normal", BOEHRINGER, Mannheim) was run. The intra-assay coefficient of variation for the method was 1.9% (n = 6), the inter-assay coefficient of variation amounted to 4.7% (n = 17) in the range of 6.8% and 7.5% of HbA_1.

3 Results and comments

3.1 Glycosylated hemoglobin in the 3 subject groups

Table II shows the accumulated values of glycosylated hemoglobin to be encountered in the 3 subject groups.

The mean HbA_1 values from the non-diabetic mothers with normal weight neonates (Group I) and from the non-diabetic mothers with macrosomic neonates (Group II) are very similar to each other and amount to 6.51% and 6.59% respectively. There is no statistically significant correlation between the HbA_1 values and the neonatal birthweights.

Gestational diabetics prior to specific therapy (Group III) demonstrate a mean HbA_1 value of 7.11%. The HbA_1 values from the gestational diabetics differ significantly from those obtained in the two non-diabetic subject groups: Group I vs. Group III, $\chi^2 = 16.92$, $p < 0.001$; Group II vs. Group III, $\chi^2 = 12.23$, $p < 0.001$, 1 degree of freedom.

Tab. II. Accumulated values of HbA_1 in the three subject groups

	Number of patients examined	Glycosylated hemoglobin (%)			
		Mean ± s.d.	Mean – 2 s.d.	Mean + 2 s.d.	Min. – Max.
Non-diabetic mothers with normal weight neonates	69	6.51 ± 0.46	5.59	7.43	5.31–7.73
Non-diabetic mothers with macrosomic neonates	33	6.59 ± 0.42	5.75	7.43	5.73–7.49
Gestational diabetics during the third trimester	51	7.11 ± 0.56	5.99	8.23	6.03–8.43

Figure 2 depicts the distribution of the individual HbA_1 values in the three groups investigated. Within each group a considerable scatter of the measured values can be recognized. More important, there is a vast overlapping of the HbA_1 values from the non-diabetic mothers and the gestational diabetics. This implies that – on the basis of one or more HbA_1 values situated in the area of overlapping – the physician will not readily be able to differentiate between a non-diabetic pregnancy and another one complicated by gestational diabetes.

In contrast, HbA_1 values above or below the 95% confidence limits for the appropriate metabolic groups are of high diagnostic significance. An individual HbA_1 value above 7.4% ($\bar{x}$ + 2 s.d. for Group I) or below 6.0% ($\bar{x}$ – 2 s. d. for Group III) will prove or exclude with a high degree of probability the existence of gestational diabetes. This is valid if there are no severe concomitant diseases in the pregnant woman which could alter the rate of HbA_1 (for instance hemolytic anemia, renal insufficiency, pre-gestational overt diabetes mellitus) and she did not receive a prolonged therapy with agents known to cause hyperglycemia (sympathicomimetic agents, thiazide diuretics, corticosteroids etc.) before HbA_1 assay.

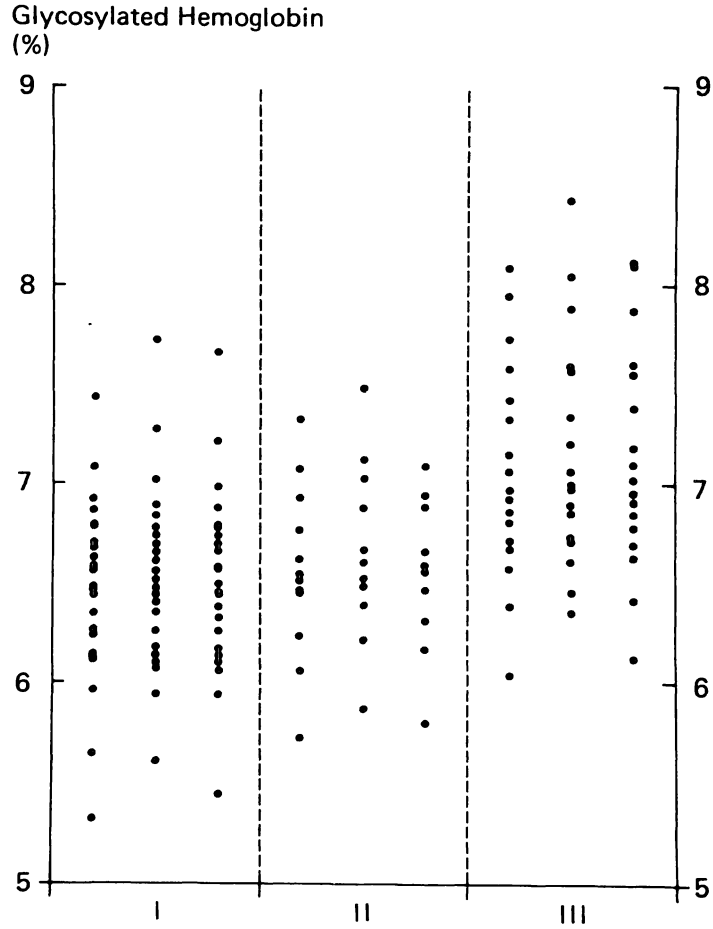

Fig. 2. Individual HbA_1 values in the three subject groups.
Group I: non-diabetic mothers with normal weight neonates;
Group II: non-diabetic mothers with macrosomic neonates;
Group III: gestational diabetic mothers in the 3rd trimester prior to diabetes therapy.

3.2 Neonatal outcome in the 3 subject groups

Table III presents clinical data on the neonates from the mothers examined.

The macrosomic neonates from non-diabetic mothers had an average overweight of almost 1 kg compared with that of their normal weight counterparts. The rate of delivery by cesarean section in the macrosomic group II was twice as high as that in Group I. As judged by the SALING score [20] recorded 5 minutes after delivery, the postpartum status of the macrosomic infants was just as good as that of the normal weight infants of Group I. Their mean plasma glucose concentration measured one hour after delivery was slightly lower than that in the infants of Group I.

In the neonates of our gestational diabetics – appropriately treated – the average birthweight amounted to 3405 g and was 150 g higher than that in Group I. Their mean plasma glucose concentration recorded one hour after delivery was the same as that in the macrosomic infants of Group II, i.e. 49 mg/100 ml. In 10 of the infants investigated however, hypoglycemias with plasma glucose levels below 40 mg/100 ml were observed. The postpartum status of the neonates from the gestational diabetic women was nearly as good as that of the infants from the non-diabetic mothers. – In this connection it must be emphasized that the gestational diabetics received a closely controlled therapy with appropriate diet, and in some cases with additional insulin injections. Taken as a whole, the infants of the gestational diabetics did not suffer serious impairment caused by the maternal metabolic disorder, provided it was treated in time and consistently.

Tab. III. Clinical data on the neonatal outcome in the three subject groups

	Birth weight (g)	Placental weight (g)	SALING score 5 min. p.p. (points)	Plasma glucose 1 hr. p.p. (mg/100 ml)	Vaginal delivery (%)	Cesarean section (%)
Normal weight neonates of non-diabetic mothers	3260 ± 268	617 ± 110	10.9	56 ± 14	97.1	2.9
Macrosomic neonates of non-diabetic mothers	4172 ± 142	771 ± 114	11.0	49 ± 11	93.5	6.5
Neonates of gestational diabetic mothers	3405 ± 519	641 ± 139	10.6	49 ± 19	93.4	6.6

The scoring criteria of SALING [20] for the assessment of the postpartum status are similar to those of APGAR. "Placental weight" includes the weight of the membranes and of the placenta-adherent proportion of the cord. – Data presented: $\bar{x} \pm$ s.d.

The ratios between placental weight: neonatal weight in the non-diabetic groups and the gestational diabetic group were virtually identical: Group I 0,19, Group II 0,18, Group III 0,19.

4 Discussion

In the present study the quantity of glycosylated hemoglobin in non-diabetic mothers with normal OGTT during late pregnancy and normal weight offspring, (Group I) was 6.51 ± 0.46% of total hemoglobin. GAIN et al. [5] using an ion-exchange chromatographic assay very similar to ours, demonstrated that HbA_1 in non-pregnant persons with normal OGTT amounted to 6.45 ± 0.62%. Obviously, there is no appreciable difference between the HbA_1 levels in pregnant and non-pregnant subjects with normal glucose regulation.

The upper normal limit of HbA_1 in our non-diabetic mothers with normal weight offspring was 7.43% ($\bar{x}$ + 2 s. d.). HbA_1 values beyond this 95% confidence limit must be regarded incompatible with normal glucose regulation. HbA_1 values between 6.97% ($\bar{x}$ + 1 s.d.) and 7.43% ($\bar{x}$ + 2 s.d.) – or grossly spoken, above 7% and below 7.4% – lie over the upper 70% confidence limit of non-diabetics and are therefore suspected of impaired glucose tolerance or gestational diabetes.

As mentioned above, there were only slight and insignificant differences between the mean values and standard deviations for glycosylated hemoglobin in non-diabetic mothers with macrosomic neonates (Group II) and those in non-diabetic mothers with normal weight infants (Group I).

The proportion of glycosylated hemoglobin to total hemoglobin is significantly increased in overt diabetes as a result of prolonged hyperglycemia. In principle, the same is partially valid in gestational diabetes, as could be shown in this paper. However, when looking more closely at the individual HbA_1 values determined in the gestational diabetic group, only 29% of them (15 out of 51) are situated above HbA_1 7.4% and thus definitely pathological. Above HbA_1 7.0% – the 70% confidence limit and "warning limit" of Group I – there are more than a half of the HbA_1 values determined in the gestational diabetic group (26 out of 51). Notably, almost half of the HbA_1 values determined in untreated gestational diabetes (25 out of 51) lies below the HbA_1 of 7% and are for this reason undistinguishable from the "non-diabetic" HbA_1 values, an observation which evidently confines the usefulness of HbA_1 determinations for diagnosing prolonged pregnancy-related disorders of glucose regulation (Fig. 3).

Under these circumstances, in the majority of cases with suspected gestational diabetes, HbA_1 assay cannot simply replace the classical oral glucose tolerance test to make the diagnosis. As a rule, the two tests must be complementarily applied for diagnostic ascertainment or exclusion of gestational diabetes.

Since the individual level of glycosylated hemoglobin is a rather inert and slowly changing parameter, HbA_1 values measured in maternal blood samples withdrawn a few days after delivery are

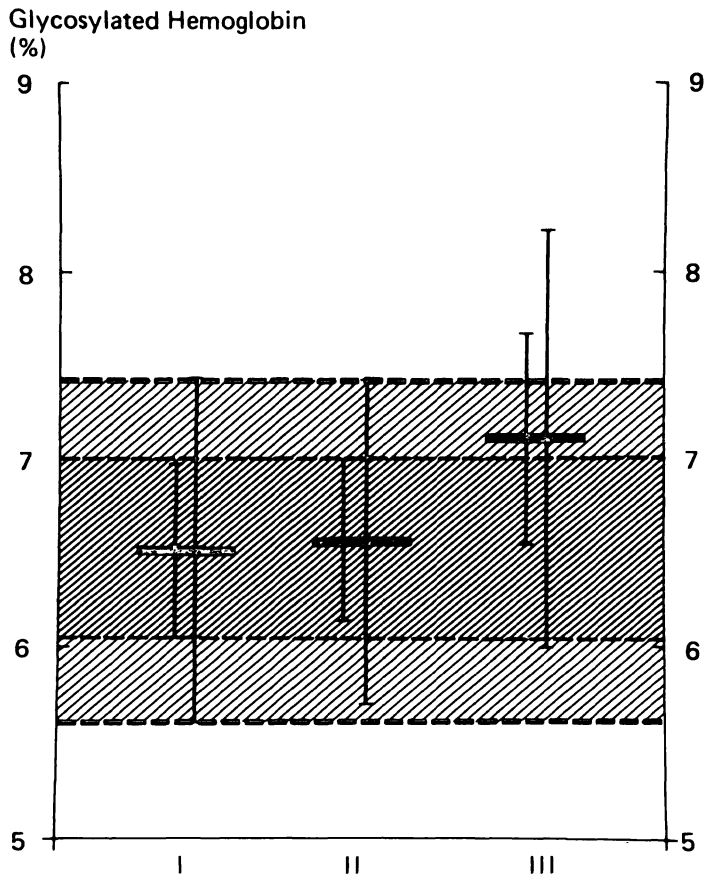

Fig. 3. Mean values of HbA_1 with one or two standard deviations in three subject groups. The shaded areas represent the 70% and 95% confidence ranges for Group I. Note the overlapping in the HbA_1 values of non-diabetic groups I, II with those of the gestational diabetic Group III. HbA_1 values above 7.4% – i.e. the upper 95% confidence limit of the non-diabetic mothers – must be regarded as abnormal.

virtually equal to those obtained during the last week before delivery. For that reason postpartum HbA_1 values from mothers of macrosomic infants may be of clinical interest in the subsequent diagnosis of a previously unsuspected and undetected diabetes. The knowledge of a gestational diabetes can be important for the mother with regard to the proper management in case of a future pregnancy, which would in all probability be complicated by gestational diabetes again.

For the time being, HbA_1 assay by means of miniaturized cation-exchange chromatography columns, based on the work of TRIVELLI et al. [23], is the method of choice in clinical use [11, 14, 16]. Since measurements of HbA_1 can now be carried out accurately, precisely and promptly, they are a useful tool in diagnosing and monitoring diabetes mellitus of all types. Recently HbA_1 assays have also been applied for detection of impaired glucose tolerance in non-pregnant patients [5, 7, 24].

The present paper attempts to show the possibilities and limitations in diagnosing gestational diabetes by quantitation of glycosylated hemoglobin. In order to draw the proper medical conclusions from the HbA_1 values obtained from the intermingling zones of normal glucose regulation in pregnancy and gestational diabetes, a high degree of reliability of the measurements is demanded. To avoid erroneously high HbA_1 readings caused by the labile aldimine fraction [8], blood samples should be obtained after overnight fasting. They should be stored for no longer than 3 days at 23°, 2 to 4° or −20°C, until their processing [21, 22], because the ion-exchange methods are associated with a marked increase in HbA_1 values after prolonged sample storage [12]. Another important source of incorrect HbA_1 results is chromatography at different temperatures.

On observance of some intrinsic premisses, HbA_1 assay can be used as a suitable additional chemical indicator in the diagnostic confirmation or exclusion of gestational diabetes.

Summary

Glycosylated hemoglobin (HbA_1) was determined in three subject groups: 69 non-diabetic mothers who were delivered of normal weight infants at term (Group I), 33 non-diabetic mothers who were delivered of macrosomic infants (> 4000 g) at term (Group II), 51 gestational diabetics in the 3rd trimester – before onset of the diabetes therapy (Group III). In all three groups diagnostic assessment of glucose regulation was done by means of the oral glucose tolerance test during the 3rd trimester. Glycosylated hemoglobin was assayed by cation-exchange chromatography in small disposable columns.

The mean values and standard deviations of HbA_1 were 6.51 ± 0.46% in Group I, 6.59 ± 0.42% in Group II and 7.11 ± 0.56% in Group III. Between the HbA_1 values of Group III (gestational diabetes) on the one hand and

those of the non-diabetic groups I and II on the other, there were highly significant differences ($p < 0.001$; χ^2-test).
HbA_1 values above 7.4 % – i.e. above $\bar{x}$ + 2 s. d. of HbA_1 in the non-diabetic mothers – were with 95 % probability abnormal and indicative of gestational diabetes. HbA_1 values between 7.0 % and 7.4 % were suspected of impaired glucose tolerance and gestational diabetes respectively.
Between the HbA_1 levels in the non-diabetic groups and those in the gestational diabetic group there was a vast zone with overlapping values. HbA_1 data situated in this transitional area could be found both in non-diabetic subjects and also in those with abnormal glucose regulation.
HbA_1 values below 6.0 % excluded gestational diabetes or otherwise impaired glucose tolerance with a high degree of probability.

As to the neonatal outcome, there were no remarkable differences in the postpartum status of the three groups investigated. The macrosomic infants of Group II were on the average 1 kg heavier than the normal weight infants of Group I. Their rate of cesarean section was twice as high as that in Group I. In the gestational diabetic group the average neonatal birthweight was 150 g higher than that of the normal weight infants of non-diabetic mothers. The infants of the gestational diabetic women showed an increased tendency to develop moderate postpartual hypoglycemias. It is noteworthy that the non-selected gestational diabetic women in our study were on the average 8 to 9 kgs havier and 4 to 5 years older than their non-diabetic counterparts. They received a closely controlled diabetes therapy during the 3rd trimester of pregnancy.

Keywords: Birthweight, gestational diabetes, glucose tolerance, glycosylated hemoglobin, HbA_1, macrosomia, neonatal outcome, oral glucose tolerance test.

Zusammenfassung

Glykosyliertes Hämoglobin (HbA_1), Glukosetoleranz und Neugeborene von gestationsdiabetischen und nicht-diabetischen Müttern
Glykosyliertes Hämoglobin (HbA_1) wurde bei drei Probandengruppen bestimmt: 69 nicht-diabetische Mütter, die von normalgewichtigen Kindern am Termin entbunden wurden (Gruppe I), 33 nicht-diabetische Mütter, die von makrosomen Kindern (> 4000 g) am Termin entbunden wurden (Gruppe II) und 51 Gestationsdiabetikerinnen im 3. Trimenon – vor Beginn der Diabetestherapie (Gruppe III). Die Bewertung der Glukoseregulation wurde in den drei Gruppen mit Hilfe des oralen Glukosetoleranz-Tests (100 g) im 3. Trimenon vorgenommen. Das glykosylierte Hämoglobin wurde mittels Kationen-Austauschchromatographie in kleinen Kunststoffsäulen untersucht.
Die Mittelwerte und Standardabweichungen von HbA_1 betrugen 6,51 ± 0,46 % in Gruppe I, 6,59 ± 0,42 % in Gruppe II und 7,11 ± 0,56 % in Gruppe III. Zwischen den HbA_1-Werten der Gruppe III (Gestationsdiabetes) einerseits und jenen der nicht-diabetischen Gruppen I und II andererseits bestanden statistisch signifikante Differenzen ($p < 0{,}001$; χ^2-Test).
HbA_1-Werte über 7,4 % – d.h. über ($\bar{x}$ + 2 s.d.) HbA_1 der nicht-diabetischen Gruppen I und II – waren mit 95 % Wahrscheinlichkeit abnorm und wiesen auf einen Gestationsdiabetes hin. HbA_1-Werte zwischen 7,0 und 7,4 % waren auf eine herabgesetzte Glukosetoleranz bzw. Gestationsdiabetes verdächtig.

Zwischen den HbA_1-Werten der nicht-diabetischen Gruppen und denen der gestationsdiabetischen Gruppen gab es einen weiten Bereich von überlappenden Werten. In diesem Übergangsbereich gelegene HbA_1-Daten konnten sowohl bei den nicht-diabetischen Frauen wie auch bei jenen mit Gestationsdiabetes gefunden werden.
HbA_1-Werte unter 6,0 % schlossen einen Gestationsdiabetes oder eine anders entstandene Beeinträchtigung der Glukosetoleranz von längerer Dauer mit hoher Wahrscheinlichkeit aus.
Was die Neugeborenen betrifft, bestanden keine nennenswerten Unterschiede hinsichtlich ihres post-partum-Status in den drei untersuchten Gruppen. Die makrosomen Kinder der Gruppe II waren durchschnittlich 1 kg schwerer als die normalgewichtigen Kinder der Gruppe I. Ihre Rate der Schnittentbindungen war doppelt so hoch wie jene in Gruppe I. In der Gruppe der gestationsdiabetischen Frauen war das durchschnittliche kindliche Geburtsgewicht ca. 150 g höher als das der normalgewichtigen Kinder von nicht-diabetischen Müttern. Die Kinder der Gestationsdiabetikerinnen zeigten eine vermehrte Tendenz zu postpartualen Hypoglykämien mäßigen Grades. Es ist bemerkenswert, daß die nicht-selektierten gestationsdiabetischen Frauen in unserer Studie im Durchschnitt 8 bis 9 kg schwerer und 4 bis 5 Jahre älter waren als die nicht-diabetischen Frauen. Sie erhielten während des 3. Schwangerschaftstrimenons eine intensiv überwachte Diabetestherapie.

Schlüsselwörter: Geburtsgewicht, Gestationsdiabetes, Glukosetoleranz, glykosyliertes Hämoglobin, HbA_1, Makrosomie, Neugeborene, oraler Glukosetoleranz-Test.

Résumé

Hémoglobine glycosylée (HbA_1), tolérance glucidique et devenir neonatal chez les mères présentant un diabète gestationnel et chez les mères non diabétiques
On a dosé l'hémoglobine glycosylée (HbA_1) dans trois groupes de sujets: chez 69 mères non diabétiques ayant donné naissance à terme à des enfants de poids normal (groupe I), chez 33 mères non diabétiques ayant accouché à terme d'enfants macrosomes (> 4000 g) (groupe II), et chez 51 femmes ayant un diabète gestationnel au cours du 3ème trimestre, les dosages ayant été effectués avant le

début du traitement du diabète (groupe III). Dans tous les groupes, l'évaluation diagnostique de la régulation glucidique a été effectuée au moyen de l'hyperglycémie provoquée par voie orale au cours de 3 ème trimestre. L'hémoglobine glycosylée a été mesurée par chromatographie d'échange cationique sur petites colonnes à usage unique.

Les valeurs moyennes et les déviations standards de l'HbA_1 sont de 6,51 ± 0,46 % dans le groupe I, de 6,59 ± 0,42 % dans le groupe II et de 7,11 ± 0,56 % dans le groupe III. Entre les valeurs de l'HbA_1 du groupe III (diabète gestationnel) d'une part et celles des groupes I et II d'autre part, il y a une différence hautement significative ($p < 0{,}001$; χ^2-test).

Des valeurs d'HbA_1 au-dessus de 7,4 % – c'est-à-dire au-dessus de $\bar{x} + 2$ dsd'HbA_1 chez les mères non diabétiques – représentent une probabilité de 95 % d'anomalie et indiquent un diabète gestationnel. Les valeurs d'HbA_1 comprises entre 7 et 7,4 % sont suspectes d'une mauvaise tolérance glucidique et retrospectivement d'un diabète gestationnel.

Entre les taux d'HbA_1 des groupes de non diabétiques et ceux de groupe de diabétiques il y a une grande zone de chevauchement. Les valeurs d'HbA_1 situées dans cette zone de transition peuvent être trouvées à la fois chez des patientes non diabétiques et à la fois chez des patientes présentant une anomalie de la régulation glucidique.

Les valeurs d'HbA_1 inférieures à 6 % éliminent un diabète gestationel et également une tolérance glucidique anormale avec une probabilité très élevée.

Il n'y a pas de différences remarquables dans l'état au cours du post-partum comme dans le devenir néo-natal dans les trois groupes explorés. Les enfants macrosomes du groupe II pèsent en moyenne un lg de plus que les enfants de poids normal du groupe I. Le pourcentage de césarienne est deux fois plus élevé que dans le groupe I. Dans le groupe des diabétiques la moyenne des poids de naissance est plus élevée de 150 g que celle des enfants de mères non diabétiques. Les enfants des mères ayant présenté un diabète gestationel montrent une tendance accrue à présenter une hypoglycémie modérée du post-partum. Il est remarquable que dans notre étude les patientes non sélectionnées avec un diabète gestationel pèsent en moyenne 8 à 9 Kg de plus et sont de 4 à 5 ans plus âgées que les témoins non diabétiques. Elles ont reçu un traitement étroitement surveillé au cours du 3ème trimestre de la grossesse.

Mots-clés: Devenir néonatal, diabète gestationel, HbA_1, hémoglobine glycosylée, hyperglycémie provoquée par voie orale, macrosomie, poids de naissance, tolérance glucidique.

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