GLYCOSYLATED HAEMOGLOBIN

SUJATA A. DALVI ● SANGEETA AGARWAL ● NISHIGANDHA DESAI ● SHIRISH S. SHETH

SUMMARY

A study was conducted to determine the significance of glycosylated hemoglobin (HbAIC) in detecting diabetes in pregnancy and predict its value for fetal outcome. A total of 68 patients were analysed for HbAIC values during prenatal or early postpartum period. The sensitivity of HbAIC was 28.58% and specificity was 85.18% in detecting patients with carbohydrate intolerance. 21.43% of the patients with an elevated HbAIC delivered macrosomic infants and none with normal levels. HbAIC is an indicator of overall glucose control. An elevated values at 32 weeks of gestation predicts the increased possibility of macrosomia and in post-partum period, unsuspected gestational diabetes.

INTRODUCTION

Glysosylated hemoglobin (HbAIC) has been co-related with antecedent plasma sugar levels and is expressed as an index of long term glucose control (Artal et al 1984, Cousin et al 1984). The detection of diabetes requires demonstration of abnormal glucose tolerance test. Several simple screening methods have been devised to avoid time consuming tests. Hence, retrospective study was undertaken to evaluate the significance of glycosylated haemoglobin in detecting diabetes in pregnancy and highlight its predictive value for fetal outcome.

MATERIAL AND METHOD

The patients with previous bad obstetric history or with evidence of large babies (> 3.5 kg.), hydramnios, congenitally malformed fetus and poor fetal outcome in current pregnancy were selected for this study (Table I). The

Dept. of Obst. & Gyn. K. E. M. Hospital, Parel, Bombay.

Accepted for Publication on 07.03.1994.

total of 68 such patients between the age group of 20 to 35 years were analysed for HbAIC values during antenatal or early post-partum period from the Department of Obstetrics and Gynaecology at K.E.M, Hospital, Bombay. The parity ranged from 1 to 6, with 18 primiparous patients. 48 were registered and 20 were emergency admissions. The HbAIC was carried out by thiobarbuturic acid method. The value of 6.78% and above was considered to be elevated. The patients with hemoglobin values less than 10 gm%, hemoglobinopathies and uremia were excluded from the study. The HbAIC values were co-related with plasma glucose values and if needed, with 100 gms of oral glucose tolerance test. The obstetrical outcome, particularly fetal status and birth-weight were noted and corelated with HbAIC values.

RESULTS

The co-relation between HbAIC and plasma glucose values is shown in Table II.

There were 14 patients with an elevated and 54 patients with normal HbAIC value. The sensitivity was 28.58% and specificity was 85.18% of HbAIC in detecting patients with carbohydrate intolerance.

Table III shows the relationship between congenitally malformed fetus, HbAIC and plasma glucose values.

Two out of 11 patients with major congenitally malformed fetuses had an elevated HbAIC.

Table IV co-relates the birth weights with HbAIC.

Three out of 14 patients (21.43%) with an elevated HbAIC delivered macro-

Table I

Selection Criteria

Criteria	No. of Patients		
	Primi	Multi	Total
Past BOH	—	10	10
Cong. Malformed fetus	5	11	16
Large Babies (> 3.5 kg)	6	5	11
Hydramnios	1	1	2
Poor fetal outcome	6	23	29
Total	18	50	68

Table II

HbAIC and Plasma Glucose Values

	↑ HbAIC	(N) HbAIC
Hyperglycemia	4 (28.57%)	8 (14.81%)
Normoglycemia	10 (71.43%)	46 (85.19%)
Total	14	54

Sensitivity : 28.58%
Specificity : 85.18%

Table III

↑ HbAIC	Congenitally Malformed		
	Live	FSB	MSB
Hyperglycemia	1	—	—
Normoglycemia	1	—	—
(N) HbAIC			
Hyperglycemia	1	1	—
Normoglycemia	3	1	3
Total	6	2	3

Table IV

Corelation between birth weight and HbAIC

	↑ HbAIC	(N) HbAIC
Normosomia	11	54
Macrosomia	3 (21.43%)	—
Total	14	54

somic infants. (Birth weight > 90 percentile for that gestational age) in contrast to none with normal HbAIC values.

DISCUSSION

Glycosylated hemoglobin (HbAIC) is a representative of long term glucose control in pregnant and non-pregnant diabetic patients and it has a direct corelation to mean plasma sugar values. HbAIC is formed by non-enzymatic glycosylation of hemoglobin A, which occurs slowly throughout the life span of red blood corpuscles. HbAIC is formed at a rate dependent on time averaged blood glucose concentration to which R.B.C. is exposed (Jovanovic L, Peterson C.M. 1981). It comprises of 5% of total hemoglobin in non-diabetic individual but it may be elevated to two to three fold in individuals with glucose intolerance (Widness et al, 1978). Hence, HbAIC is a new clinical tool to assess plasma glucose control for labile diabetes like gestational diabetes.

Markedly elevated HbAIC reflects prior plasma glucose level of greater than 140 mg% (O'Shaughnessy R et al, 1979). In labile diabetics, with an elevated HbAIC and fasting plasma glucose levels, detection of abnormal glucose tolerance test is not necessary for the diagnosis.

Ability to detect high proportion of true positives and true negatives indicate sensitivity and specificity respectively, in identifying patients with carbohydrate intolerance. Our study shows the sensitivity rate of 28.59%, which is lower than the reports of others. (Shah et al 44%, 1982; Baxi et al 63.6%, 1984; O' Sullivan et al 79%, 1973). This could be due to HbAIC Values carried out in early post partum state in 73.53% of our patients. The specificity of our study is 85.18% which is in agreement with the reports of others. (Shah et al 86.5%, 1982; Baxi et al 81.6%, 1984; O' Sullivan et al 87%, 1973).

HbAIC is an indicator of overall glucose control. As a screening tool for gestational diabetes, it has a poor sensitivity (Roberts et al 1973).

The "on" rate of HbAIC is more rapid than off rate i.e. HbAIC rises within a week of rise of plasma glucose values but declines to normal level, following 4-6 weeks of fall of plasma glucose values to normal. Hence, HbAIC reflects the mean plasma glucose values over the previous 4-6 weeks (Jovanovic & Peterson, 1981). This is the main basis for using it in post partum mothers, of large for gestational age or still born infants, where an elevated HbAIC values retrospectively documents unsuspected gestational diabetes (Coen R.W. et al, 1980; Steel J.M. et al, 1981; Widness J.A., et al 1978).

An elevated HbAIC values in the

second trimester of pregnancy are associated with major congenital malformations of the fetus in 40% of the patients (Ylinen et al, 1981). In present series, 18.18% of the patients with an elevated HbAIC had congenitally malformed fetuses of major degree. This is probably because the HbAIC values were done in the third trimester and early post partum period and not in the second trimester of pregnancy.

Poor fetal outcome and macrosomia is a known problem among the infants of diabetic mothers. Abnormal plasma glucose levels from 26 weeks of gestation may predispose the infants to macrosomia. This can be prevented with strict control of glucose. Hence, HbAIC, can be used as an alternate criterion of glucose control. Our study shows that 21.43% of the patients with an elevated HbAIC delivered macrosomic infants and none with normal HbAIC. The study by Baxi et al shows 50% of the patients with an elevated HbAIC delivers macrosomic infants and none with normal HbAIC.

The value of HbAIC at approximately 32 weeks of gestation may predict increased possibility of macrosomic infants (Dorothy, Reycroft, Hollingsworth, 1992), (Jovanovic L, Peterson C.M. 1981) and warrant aggressive management, as frequent plasma glucose monitoring is not a routine practice. This being tedious, requires greater patient compliance, besides reflects glycemic control of only one particular day (Kanitkar et al, 1990).

CONCLUSION

Glycosylated haemoglobin (HbAIC) is an indicator of overall glucose control. For screening for gestational diabetes, it has poor sensitivity. An elevated HbAIC values in post partum patients leads to retrospective documentation of unsuspected gestational diabetes. An elevated HbAIC values at around 32 weeks of gestation predict the increased possibility of macrosomic infant and alerts the obstruction.

ACKNOWLEDGEMENT

We, thank the Dean, Dr. P. M. Pai and Head of Department of Obstetrics and Gynaecology, Dr. M. S. Bhattacharyya of Seth G.S. Medical College and K.E.M. Hospital, Bombay for allowing us to publish the hospital data.

REFERENCES

1. *Artal R., Morley GM, Dorey FJ : Am. J. Obstet. & Gynec. : 148;412;1984.*
2. *Baxi L., Barad D., Reece A.E. and Ferber R. : Obstet & Gynec. Survey : 64;347;1984.*
3. *Coen Ronald W., Parreco Richard, Cousins Larry, Sandler J.A. : Am. J. Obstet. Gynec.: 136;380;1980.*
4. *Cousins L., Dattel BJ, Hollingsworth Dr. Zettnr A. : Am. J. Obstet. Gynec. : 150;455;1984.*
5. *Dorothy, Reycroft, Hollingsworth : A management guide : Second Edition, Williams and Wilkins, : 150;1992.*
6. *Jovanovic L, Peterson M. : Am. J. of Medicine: 70;331;1981.*
7. *Kanitkar V., Bucksshee K.., Takkar D., Karmarkar M.G. : J. of Obstet. & Gynec. of India : 40;201;1990.*
8. *O' Shaughnessy Richard, Russ John, Zuspan F.P. : Am. J. Obstet. & Gynec. ; 135;783;1979.*
9. *O' Sullivan J.B., Mahan C.M., Charles D., Dandraw R.V. : Am. J. Obstet. & Gynec. : 116;895;1973.*
10. *Robert A.B., Court D.J., Henley P. and Baker J.R., James A.G., Ronayene I.D. : The Lancet : 29;998;1973.*
11. *Shali B.D., Cohen A.W., May C., Gabbe S.G.: Am. J. Obstet. & Gynec. : 144;774;1982.*

12. *Steel JM, Thompson P., Johnstone F., Smith AF : Brit. Med. J. : 282;1357;1981.*
13. *Widness J.A., Schwartz H.C., Thompson Diana King K.C., Kahn C.B., Oh W. and Schwartz R. : J. of Pedia. : 92;8;1978.*
14. *Widness J.A., Schwartz H.C., Thompson Diana, Kahn C.B. Oh and Schwartz R. : J. of Obstet. & Gynec. : 85;812;1978.*
15. *Ylinen K., Raivio K., Teramo K. : Brit. J. Obstet. & Gynec. : 88-961;1981*