J Obstet Gynecol India Vol. 56, No. 6 : November/December 2006 Pg 499-501

ORIGINAL ARTICLE

The Journal of Obstetrics and Gynecology of India

Glucometer screening of gestational diabetes

Das *Vinita* [1], Jain *Vaishali*[1], Agarwal *Anjoo*[1], Pandey *Amita*[1], Pandey *Sushma*[1], Agarwal *CG*[2],

Departments of [1] Obstetrics and Gynecology and of [2] Medicine, King George's Medical University, Lucknow.

OBJECTIVE(S) : To evaluate the usefulness of glucometer screening during pregnancy and to determine a suitable cut off value for glucometer screening.

METHOD(S) : Two hundred women between 24 and 28 weeks of gestation attending our antenatal clinic were screened for blood sugar level by laboratory and glucometer methods 1 hour after 50g glucose load.

RESULTS : Forty-three (21.5%) had abnormal screening on laboratory testing. On glucometer screening only 22 (51.1%) of these women were detected to be abnormal taking plasma sugar value of 140 mg/dL as cut off value for positivity by both the methods.

CONCLUSION(S) : Laboratory testing of venous plasma glucose is superior to capillary glucometer screening. Optimal screening cut off value on glucometer screening on drawing a receiver operater characteristic (ROC) curve is also140 mg/dL with sensitivity of 66.6% and specificity of 79.3%.

Key words : gestational diabetes screening, glucometer.

Introduction

Gestational diabetes mellitus (GDM) is the commonest metabolic disorder during pregnancy affecting approximately 3-5% of pregnancies [1]. The high maternal and perinatal mortality and morbidity associated with undiagnosed and untreated GDM make us anxious to detect disorders of glucose metabolism at the earliest during pregnancy. This desire has paved the way for an efficient screening test. The most commonly accepted screening test is estimation of venous plasma glucose level 1 hour after a 50g glucose load using 140 mg/dL as a cut off value.

The present study was conducted to assess the efficacy of glucometer testing of capillary blood after a similar glucose load and to find a comparable cut off value.

Paper received on 30/08/2005 ; accepted on 25/08/2006

Correspondence :
Dr. Anjoo Agarwal
Department of Obstetrics and Gynecology
C-846, Mahanagar, (UP).
Te. 91-522-2321230
Email : corpmate@gmail.com

Methods

Two hundred pregnant women attending our antenatal clinic were included in the study. Approval was obtained from the ethical committee. Informed consent was obtained from all the subjects. All women underwent a detailed history and examination with special emphasis on the risk factors for gestational diabetes such as previous still births, congenitally malformed babies, obesity, family history of diabetes etc. Known diabetics were excluded from the study. Universal screening was done between 24-28 weeks of gestation irrespective of the presence or absence of risk factors. All women underwent the standard venous plasma glucose screening test simultaneously with glucometer testing of capillary blood. They were given a 50g glucose load irrespective of fasting status and both venous and capillary blood were taken 1 hour after the glucose load. Venous blood was tested by glucose oxidase method. Capillary blood was tested with one touch Accu-check I glucometer. If blood glucose was >140mg/dL by either method then the screening test was considered positive. Positively screened women were subjected to the 100g oral glucose tolerance test (OGTT) and gestational diabetes was diagnosed if any two out of the four values (fasting, 1 hour, 2 hour, 3 hour) were abnormal by National Diabetes Data Group recommendations.

Results

Out of the 200 women included in the study, 86 belonged to the high risk group and 114 to the low risk group. Forty-three i.e. 21.5% of study population (comprising 24 of high risk group and 19 of low risk group) were positive on screening by estimation of venous plasma glucose level. On further testing of these 43 women by 100g OGTT 3% of study population (comprising four of high risk group and two of low risk group) were diagnosed to be gestational diabetics. Out of these 43 women positively screened on laboratory testing, only 22 (51.2%) were positive on capillary testing using a cut off value of 140mg/dL, which included four cases of GDM (66.67%). Besides this, on capillary testing another 22 women were positive on screening which were negative on laboratory screening and none of these had GDM.

The sensitivity, specificity and false positive rates were calculated for different cut off values for venous plasma laboratory testing and for capillary blood glucometer testing as shown in Tables 1 and 2 to find out the appropriate cut off value for our population.

Table 1. Sensitivity, specificity and false positive rate using various cut off limits of laboratory test (venous plasma glucose values in mg/dL).

	Laboratory test (mg/dL)						
	≥140	≥145	≥150	≥155	≥160	≥165	>170
Sensitivity	100	66.6	66.6	50	33.3	16.6	16.6
Specificity	80.9	86.6	87.1	90.2	91.7	94	94
False positive rate	19	12.8	12.3	9.2	8.2	6.1	6.1

Table 2. Sensitivity, specificity and false positive rate using various cut off values for capillary glucose estimation by glucometer (One touch) mg/dL).

	Glucometer testing (mg/dL)								
	≥130	≥135	≥140	≥145	≥150	≥155	≥160	≥165	≥170
Sensitivity	66.6	66.6	66.6	50	50	33.3	16.6	16.6	16.6
Specificity	65.4	73.1	79.3	86	87.1	91.75	93.8	94.8	95.8
False positive rate	34.5	26.8	20.6	13.9	12.8	8.2	6.1	5.1	4.1

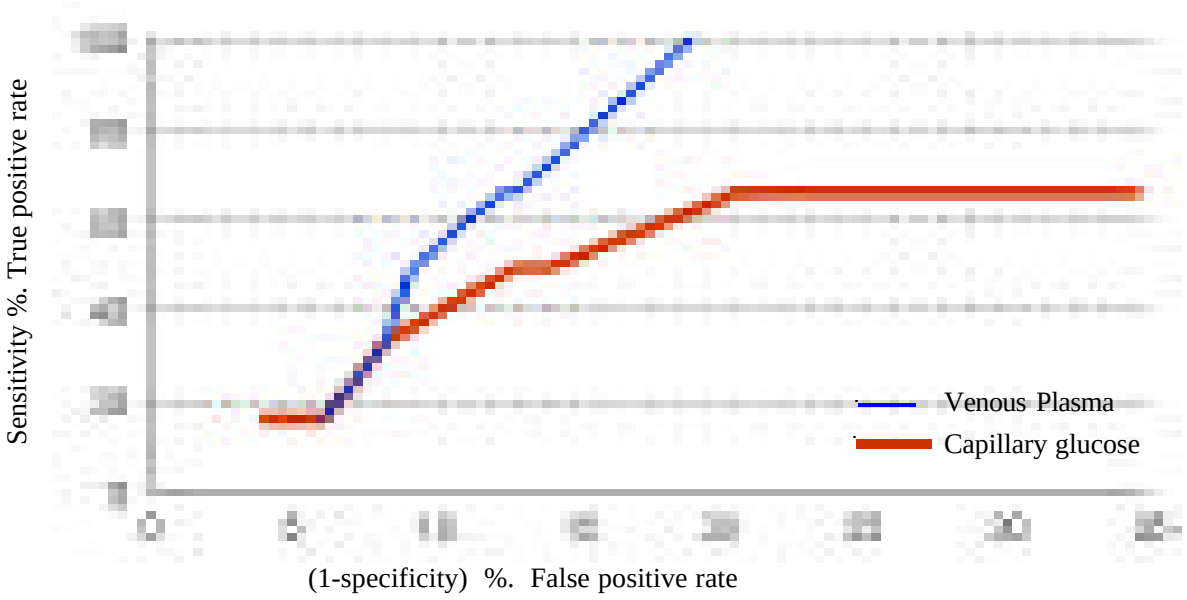

Figure 1. Receiver operator characteristic curve between venous plasma glucose estimation and glucometer capillary glucose estimation.

Discussion

Figure 1 shows the receiver operator characteristic (ROC) curve comparing the two screening tests. An ideal screening test should have a high true positive rate and a low false positive rate. A cut off value of 140mg/dL on venous plasma laboratory testing approaches close to this ideal with a true positive rate of 100% and a false positive rate of only 19%. Raising the cut off limit even to 145 mg/dL in an attempt to bring down the false positive rate leads to an unacceptable fall in the true positive rate to 66.6%. Similarly, when the capillary blood glucometer values were studied the cut off value of 140 mg/dL was found to be optimal with a true positive rate of 66.6% and a false positive rate of 20.6%. Lowering the cut off value to 130 mg/dL was associated with a rise in the false positive rate without a concomitant rise in the true positive rate. Raising the cut off value was associated with a marked fall in the true positive rate.

Our findings are not consistent with those of Landon et al [2] who found 160 mg/dL to be the optimal cut off value for capillary blood glucometer screening. Weiner and Faustich [3] found 150 mg/dL to be an ideal cut off value for capillary blood glucometer screening. Murphy et al [4] have concurred with the value of 150 mg/dL.

Venous plasma laboratory cut off value of 140 mg/dL is supported by the study of Cousins et al [5].

Conclusions

Venous plasma laboratory testing is superior to capillary blood glucometer screening due to higher sensitivity. But in emergency situations capillary blood glucometer testing is an adequate alternative using 140 mg/dL as the cut off value. Universal screening is mandatory as 44.1% of the positive screened women and 33.3% of the gestational diabetic women belong to the low risk group.

References

1. Danilenko-Dixon DR, Van Winter TJV, Nelson RL et al. Universal Vs. selective gestational diabetes screening – application of 1997 ADA Recommendation. *Am J Obstet Gynecol 1999 ;181:798-802.*
2. Landon MB, Cembrowski CS, Gabbe SG. Capillary blood glucose screening for gestational diabetes: A preliminary investigation. *Am J Obstet Gynaecol 1986 ; 155:717-21.*
3. Weiner CP, Faustich MW. Diagnosis of gestational diabetes by capillary blood sample and a portable reflectance meter: Derivation of threshold values and prospective validation. *Am J Obstet Gynecol 1987; 156:1085-9.*
4. Murphy NJ, Meyer BA, O'Kell RT et al. Screening for gestational diabetes mellitus with a reflectance photometer accuracy and precision of the single operator model. *Obstet Gynecol 1994;83:1038-42.*
5. Cousins L, Baxi L, Chez R et al. Screening recommendations for gestational diabetes mellitus. *Am J Obstet Gynecol 1991; 165:493-6.*