Comparison Between Point of Care Glucose Measurement and Laboratory Measurement in Diagnosis of Diabetes Mellitus

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Abstract

Background: The diagnosis of diabetes mellitus depends on estimation of plasma glucose when the subject is fasting using classical laboratosy methods, to date, only limited number of studies have addressed the applicability of point-of-care glucose testing in the diagnosis of diabetes.

Objective: To compare point of care glucose meter to control laboratory method in the diagnosis of diabetes.

Patients and Methods: Fifty one subjects recruited, their age ranged from 36-70 years. The questionnaire included socio-demographic information and date of interview, A finger stick blood sample was obtained and fasting blood glucose measurement were performed for each subject and recorded using Roche Accu-check active glucose meter. At the same time a 2ml of venous blood was taken from the same subjects and plasma glucose measured within one hour using laboratory enzymatic method and the results recorded.

Results: In the current study 94%2 of the samples measured by point of care method were within ± 20% of the laboratory values, 2 subjects discovered to be diabetic by both methods but there was significant difference between both methodologies.

Conclusion: Point of care glucose testing can be used as a part of diagnostic process of diabetes. However there was a significant difference between both methodology.

Key words: Glucose blood self-monitoring, Blood chemical analysis.

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Introduction

It is well known that diabetes is common in developing countries including Iraq and continues to increase in prevalence. regarding USA, In individuals older than 20 years 8-9% of population is diabetic, Measurement of glucose in plasma of fasting subjects is widely accepted as a diagnostic criteria for diabetes, Glucose is measured in central laboratories using enzymatic methods predominantly with glucose oxidase or hexokinase [1].

Point-of-care (POC) is often used to determine glucose levels when frequent monitoring of glucose is important [2]. Point of care is, testing at or near the site of patient care [3].

To date only a limited number of studies have addressed the applicability of point-of-care glucose testing in the diagnosis of diabetes [4].

This study was carried out to compare between point of care and laboratory measurement methods in diagnosis of diabetes mellitus.

Materials and Methods

Cross sectional study was carried out from the first November 2010 to the end of

same month at Rezgary and howler teaching hospitals Erbil-Iraq. Daily we were attending in patient department of the hospitals. Subjects accompanying admitted patients who were females, free from apparent diseases and fasting were included in the study, 51 recruited their age ranged from 36-70 years. An informed consent was sought and obtained from each participant before taking blood samples. A questionnaire which included socio-demographic information and date of interview was filled, then a finger stick blood sample was obtained and fasting blood glucose measurement was performed for each subject and recorded using Roche Accu check active glucose meter [5]. At the same time a2 ml of venous blood taken from the same subject and plasma glucose measured within one hour using laboratory enzymatic method and the result recorded.

Statistical analysis

Data were stored and analyzed using SPSS version 18 software. Differences between groups means were determined by independent sample t test (2 tail). The significance level was set at P≤ 0.056.

Result

The result of present study are generally presented as tables from 1-3.

Table (1): Number and percentage of samples met in the international standard for accuracy.

Number of samples	Number of gluco-meter samples with accuracy of 20% for plasma glucose reading	Percentage of glucometer samples with accuracy of 20% for plasma glucose reading
51	48	94.2

In 48 patients out of 51 the sample reading of glucometer was within 20% of plasma glucose by enzymatic method, which means 94.2% of the sample.

Table (2): Difference between point of care glucose estimation and laboratory method and its significance.

Category	Number of subjects	Mean age of subjects	Mean blood glucose by point of care method	Mean plasma glucose by laboratory method	Differences between both methods	P value
Non diabetic	51	48.24 year	95.67 Mg/100ml	103.16 Mg/100ml	7.49 Mg/100ml	< 0.001

Although the difference between enzymatic method and point-of care glucose samples was statistically significant, but still the difference is within 20% and it is acceptable.

Table (3): Cases diagnosed as diabetes by both methods.

Number	Fasting blood glucose by point of care method	Fasting plasma glucose by laboratory method
1	146 mg/100ml	147 mg/100ml
2	154 mg/100ml	167 mg/100ml

Two cases have been diagnosed as diabetes by enzymatic method and point-of care glucose measurement and their fasting samples are well above 126 mg/100ml.

Discussion

In current study there was significant difference between the means of plasma glucose measured by central laboratory method and blood glucose measured by POC whole blood glucose meters, The P was > 0.001, It was also found that 48 samples (94.2%) met the criteria of the international standard for accuracy which needs 95%. In this study 2 subjects met the criteria the diagnostic criteria of diabetes according to American clinical endocrinology association 2011, which states that fasting plasma glucose of 126 mg/100ml and more is diagnostic of diabetes mellitus by laboratory method, both of them also met the criteria by whole blood glucose[7] .

Certain studies emphasized the need to use caution in interpreting individual glucose readings obtained with a POC device . Anna Shearer et al found that in 20% of the patient studied had POC values different from the laboratory values by 20mg/100ml or more, They concluded that although there is significant difference between the two methods POC glucose meters can be a part of diagnostic workup for diabetes mellitus [8]. Wong et al found significant differences between glucose values obtained with a POC device and by the laboratory means [9]. Roger et al also stated that currently the majority of available point-of-care testing devices for glucose and HbA1c do not meet generally accepted analytical performance criteria and may therefore underestimate or overestimate the risk of diabetes [10].

Ritchie et al found that POC glucose testing appears to be a simple and reliable tool for identifying undiagnosed diabetes in a high-risk resource poor rural population [11]. Limitations of this study are the small sample size and only one type of gluco-meter has been used.

In conclusion, point-of-care glucose measurement can be used for diagnosis of diabetes with caution as there is significant difference compared to laboratory method.

We recommended, further studies to be performed on large population sample using different types of glucometer devices.

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