Performance of HbA1c and Fasting Plasma Glucose in Screening for Diabetes in Patients Undergoing Coronary Angiography

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OBJECTIVE—The performance of glycated hemoglobin (HbA1c) and fasting plasma glucose (FPG) was compared in screening for diabetes by an oral glucose tolerance test (OGTT) in patients undergoing coronary angiography (CAG).

RESEARCH DESIGN AND METHODS—Patients without known diabetes admitted for CAG were eligible. OGTT and HbA1c were assessed 2–4 weeks after hospital discharge. The performance of HbA1c and FPG was evaluated by using receiver operating characteristic (ROC) analysis.

RESULTS—Diabetes was diagnosed in 83 of 400 patients (20.8%). The area under the ROC curve was higher for FPG than for HbA1c (0.81 vs. 0.73, P = 0.032). We proposed a screening algorithm and validated it in another 170 patients. Overall, this algorithm reduced the number of OGTTs by 71.4% (sensitivity 74.4%, specificity 100%).

CONCLUSIONS—FPG performed better than HbA1c in screening for diabetes in patients undergoing CAG. A screening algorithm might help to reduce the number of OGTTs.

Diabetes Care 36:1138–1140, 2013
in 400 of 780 eligible patients (mean age 65 ± 13 years, male 75.9%, CAD 67.8%) (Supplementary Table 1). Figure 1 shows the ROC curves for HbA1c and FPG to detect NDD. Overall, the AUC was higher for FPG than for HbA1c (0.81 vs. 0.73, \( P = 0.032 \)). The optimal cutoff point was 5.6 mmol/L for FPG and 6.3% for HbA1c. In patients with CAD, the AUC was higher for FPG than for HbA1c (0.81 vs. 0.71, \( P = 0.017 \)), whereas the difference was not significant in patients without CAD (0.80 vs. 0.79, \( P = 0.881 \)).

Patients were divided into different groups according to their FPG and HbA1c levels (Supplementary Table 2). Patients with FPG 5.6–6.9 mmol/L were more insulin resistant (HOMA-IR 2.4 ± 1.5 vs. 1.7 ± 1.2, \( P < 0.001 \)) and had worse \( \beta \)-cell function (HOMA-\( \beta \) 74 ± 49 vs. 104 ± 70, \( P < 0.001 \); IGI 60 ± 57 vs. 104 ± 87, \( P < 0.001 \)) than those with FPG <5.6 mmol/L. However, in patients with HbA1c 5.7–6.4%, the HOMA-IR, HOMA-\( \beta \), and IGI were not significantly different from those in patients with HbA1c <5.7%.

On the basis of our findings, we proposed a screening algorithm (Supplementary Figure 1). Diabetes was diagnosed in patients with FPG ≥7.0 mmol/L. OGTT needs to be conducted in patients with FPG 5.6–6.9 mmol/L and may be waived in those with FPG <5.6 mmol/L. In this way, the number of OGTTs was reduced by 71.8%, and the sensitivity and specificity for detecting NDD was 73.5 and 100%, respectively.

This algorithm was tested in another 170 patients (mean age 62 ± 13 years, male 82.9%, CAD 67.1%) admitted for CAG between October 2011 and June 2012. Following this algorithm, an OGTT would be needed in 50 (29.4%) patients, and the sensitivity and specificity for detecting NDD was 76.5 and 100%, respectively.

**CONCLUSIONS**—We reported that the AUC was higher for FPG than for HbA1c in detecting NDD in patients undergoing CAG, especially in those with CAD. A recent study comparing the performance of HbA1c and fasting capillary glucose in screening for diabetes in a general Chinese population found a higher AUC for fasting capillary glucose than for HbA1c (men 0.77 vs. 0.67, \( P < 0.01 \); women 0.75 vs. 0.67, \( P < 0.01 \)) (12). These findings were in line with the present results and suggest that FPG is a better test than HbA1c in screening for diabetes.

We observed that patients with FPG 5.6–6.9 mmol/L were more insulin resistant and had worse \( \beta \)-cell function than those with FPG <5.6 mmol/L. However, in patients with HbA1c 5.7–6.4%, the indexes of insulin resistance and \( \beta \)-cell function were not significantly different from those in patients with HbA1c <5.7%.

Some studies reported that \( \beta \)-cell function progressively declined with the increase in either FPG or 2-h postchallenge glycemia (13,14). In contrast, the relationship between HbA1c and \( \beta \)-cell function was reported to be highly nonlinear (15). These results suggest that a higher-than-normal FPG might be a better index of insulin resistance and \( \beta \)-cell dysfunction than a higher-than-normal HbA1c.

There are some limitations in this study. First, only 51.3% of eligible patients participated. Second, we did not conduct a second OGTT to confirm the diagnosis, and the poor reproducibility of OGTT (3) may confound the results. Third, the efficacy of the screening algorithm has not been tested in another independent cohort.

In summary, we reported that the FPG test performed better than HbA1c in screening for diabetes in patients undergoing CAG. We proposed a screening algorithm, and its efficacy and practicability need further investigation.

**Acknowledgments**—This study was supported in part by research grants from the National Science Council, Taiwan (NSC 101-2314-B-075A-006-MY3) and Taichung Veterans General Hospital, Taichung, Taiwan (TCVGH-1013502B).

The funder played no role in the conduct of the study, collection of data, management of the study, analysis of data, interpretation of data, or preparation of the manuscript.

No potential conflicts of interest relevant to this article were reported.

J.-S.W. and W.-H.-H.S. analyzed data and wrote the manuscript. J.-T.L. and W.-J.L. designed the study and critically revised the manuscript. S.-Y.L., C.-P.F., and K.-W.L. analyzed related clinical data and contributed to discussion. J.-S.W. and W.-H.-H.S. are the guarantors of this work and, as such, had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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