Periprocedural Glycemic Control in Patients With Diabetes Mellitus Undergoing Coronary Angiography With Possible Percutaneous Coronary Intervention

Binita Shah, MD, MS[a,*], Jeffrey S. Berger, MD, MS[b,c], Nicholas S. Amoroso, MD[a], Xingchen Mai, BS[a], Jeffrey D. Lorin, MD[a], Ann Danoff, MD[d], Arthur Z. Schwartzbard, MD[a], Iryna Lobach, PhD[e], Yu Guo, MA[e], Frederick Feit, MD[a], James Slater, MD[a], Michael J. Attubato, MD[a], and Steven P. Sedlis, MD[a]

Periprocedural hyperglycemia is an independent predictor of mortality in patients who underwent percutaneous coronary intervention (PCI). However, periprocedural management of blood glucose is not standardized. The effects of routinely continuing long-acting glucose-lowering medications before coronary angiography with possible PCI on periprocedural glycemic control have not been investigated. Patients with diabetes mellitus (DM; n = 172) were randomized to continue (Continue group; n = 86) or hold (Hold group; n = 86) their clinically prescribed long-acting glucose-lowering medications before the procedure. The primary end point was glucose level on procedural access. In a subset of patients (no DM group: n = 25; Continue group: n = 25; and Hold group: n = 25), selected measures of platelet activity that change acutely were assessed. Patients with DM randomized to the Continue group had lower blood glucose levels on procedural access compared with those randomized to the Hold group (117 [97 to 151] vs 134 [117 to 172] mg/dl, p = 0.002). There were two hypoglycemic events in the Continue group and none in the Hold group, and no adverse events in either group. Selected markers of platelet activity differed across the no DM, Continue, and Hold groups (leukocyte platelet aggregates: 8.1% [7.2 to 10.4], 8.7% [6.9 to 11.4], 10.9% [8.6 to 14.7], p = 0.007; monocyte platelet aggregates: 14.0% [10.3 to 16.3], 20.8% [16.2 to 27.0], 22.5% [15.2 to 35.4], p <0.001; soluble p-selectin: 51.9 ng/ml [39.7 to 74.0], 59.1 ng/ml [46.8 to 73.2], 72.2 ng/ml [58.4 to 77.4], p = 0.014). In conclusion, routinely continuing clinically prescribed long-acting glucose-lowering medications before coronary angiography with possible PCI help achieve periprocedural euglycemia, appear safe, and should be considered as a strategy for achieving periprocedural glycemic control. **(Am J Cardiol 2014;113:1474−1480)**

Periprocedural hyperglycemia predicts adverse events and mortality in patients who underwent percutaneous coronary intervention (PCI).[1,2] Some data suggest that metabolic interventions during PCI may prevent deleterious effects of hyperglycemia.[3−5] However, glycemic control has not been consistently achieved in trials using intravenous insulin, so not all trials have demonstrated a reduction in clinical events.[6−8] There is wide variability in the management of long-acting glucose-lowering medications before coronary angiography and PCI in patients with diabetes mellitus (DM).[9] Furthermore, in the current era of coronary angiography and PCI, where procedure times are shorter, sedation is minimal, and patients are able to eat shortly after the procedure; it is not certain if there is any need to routinely hold long-acting glucose-lowering medications before the procedure as done in surgical populations. Accordingly, in this randomized clinical trial, we sought to evaluate whether routinely continuing clinically prescribed long-acting glucose-lowering medications in patients with type 2 DM before coronary angiography with possible PCI effectively achieve periprocedural euglycemia. Because hyperglycemia is associated with increased platelet activity, we also explored the effect of continuing long-acting glucose-lowering medications on relevant measures of platelet activity.[10]

Methods

All patients with type 2 DM referred for coronary angiography with possible PCI at the Manhattan Veterans Affairs Hospital were eligible to participate in the study.

Divisions of [a]Cardiology and [d]Endocrinology, Department of Medicine, Veterans Affairs New York Harbor Health Care System and New York University School of Medicine, New York, New York; and Divisions of [b]Cardiology, [c]Hematology, Department of Medicine, and [e]Biostatistics, Department of Population Health, New York University School of Medicine, New York, New York. Manuscript received December 3, 2013; revised manuscript received and accepted January 20, 2014.

Dr. Shah was partially funded by the American College of Cardiology Foundation/Merck Research Fellowship (2011 to 2012) and by an NIH/NHLBI grant T32HL098129 (2012 to 2013).

Dr. Schwartzbard is a speaker for Takeda Pharmaceuticals. Drs. Shah and Sedlis receive research support from Takeda Pharmaceuticals; this relationship did not exist during the design, conduct, and data analysis of the presented study.

See page 1479 for disclosure information.

*Corresponding author: Tel: (212) 263-4235; fax: (212) 263-8534.

E-mail address: binita.shah@nyumc.org (B. Shah).

0002-9149/14/$ - see front matter © 2014 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.amjcard.2014.01.428

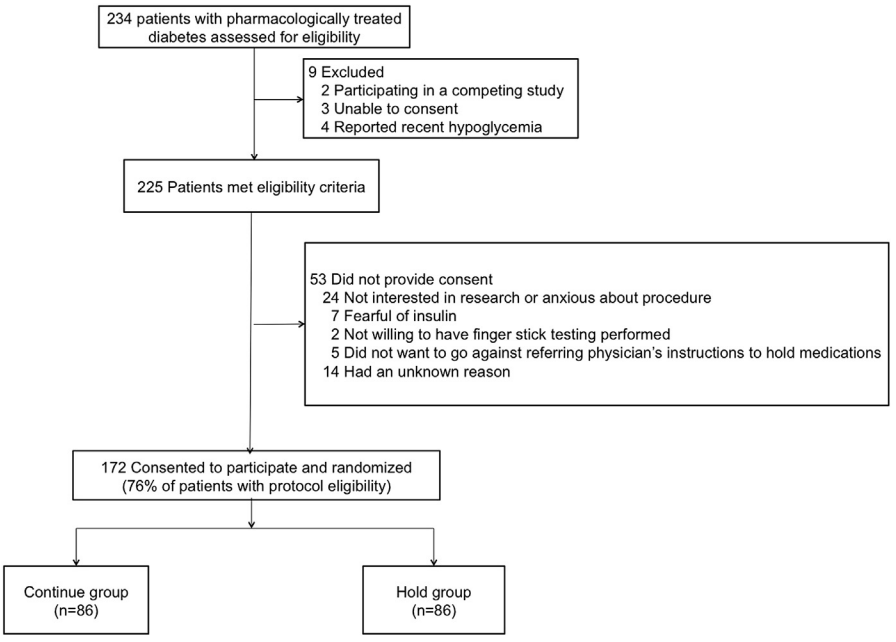

Figure 1. Screening, enrollment, and randomization of study population.

Table 1
Baseline characteristics of total cohort

Variable	Patients With DM		p Value
	Continue Group (n = 86)	Hold Group (n = 86)	
Age (yrs)	64 (60–74)	66 (62–73)	0.25
Men	85 (99)	86 (100)	1.0
White	62 (72)	63 (73)	0.58
Black	17 (20)	13 (15)	
Hispanic	7 (8)	10 (12)	
Body mass index (kg/m^2)	32 (29–36)	30 (27–35)	0.08
Abdominal circumference (in)	46 (42–50)	44 (40–48)	0.03
Previous MI	23 (27)	26 (30)	0.74
Hypertension*	81 (94)	81 (94)	1.0
Hyperlipidemia*	77 (90)	78 (91)	1.0
Chronic kidney disease	19 (22)	13 (15)	0.33
Previous stroke	15 (17)	13 (15)	0.84
Peripheral vascular disease	10 (12)	17 (20)	0.21
Tobacco use	27 (32)	17 (20)	0.11
Presenting with acute coronary syndrome	18 (21)	25 (29)	0.29
Sulfonylurea	37 (43)	39 (45)	0.88
Metformin	52 (61)	53 (62)	1.0
Thiazoladinediones	6 (7)	4 (5)	0.75
Sitagliptin	3 (4)	0	0.25
Long-acting insulin	39 (45)	35 (41)	0.64
Multiple glucose-lowering agents	40 (47)	35 (41)	0.54
Oral agents only	15 (38)	17 (49)	0.36
With insulin	25 (63)	18 (51)	
Ejection fraction			0.64
Normal	64 (76)	63 (74)	
Severely reduced	6 (7)	4 (5)	
Random glucose (mg/dl)	141 (108–197)	146 (120–186)	0.55
Hemoglobin A1c (%)	7.1 (6.5–8.5)	7.3 (6.8–8.0)	0.94
Glomerular filtration rate (ml/min)	70 (54–84)	72 (59–98)	0.08
Low-density lipoprotein cholesterol (mg/dl)	74 (59–92)	74 (61–94)	0.66
High-density lipoprotein cholesterol (mg/dl)	39 (33–45)	37 (32–45)	0.96
Triglyceride (mg/dl)	151 (106–211)	145 (105–214)	0.81
Fasting time (h)	16.1 (14.0–19.2)	17.3 (14.4–19.3)	0.41

Data are presented as n (%) and median (IQR).
IQR = interquartile range.
* Hypertension and hyperlipidemia are defined as self-reported history of or documentation of these diagnoses in a physician note in the electronic medical record system.