Journal of Clinical Lipidology (2015) 9, 241–246

Journal of Clinical Lipidology

# Disparities in lipid control and statin drug use among diabetics with noncoronary atherosclerotic vascular disease vs those with coronary artery disease

**Rashmi Thapa, MBBS, Suresh Sharma, MD, Vinodh Jeevanantham, MD, MPH, Casper Hu, BS, Taylor Myers, BS, James L. Vacek, MD, MSc, Buddhadeb Dawn, MD, Kamal Gupta, MD***

*Department of Internal Medicine, Division of Cardiovascular Diseases, University of Kansas Medical Center and Hospital, Kansas City, KS, USA*

**KEYWORDS:**
Diabetes mellitus;
Noncoronary atherosclerotic vascular disease;
Lipids;
Statin;
Peripheral arterial disease;
Carotid stenosis;
Abdominal aortic aneurysm

**BACKGROUND:** Diabetes mellitus (DM), coronary artery disease (CAD), and noncoronary atherosclerotic vascular diseases (NCVDs) have similar risks of cardiovascular events and similar recommendations for lipid control. There are limited data regarding lipid control in diabetic patients with NCVD in current clinical practice.

**OBJECTIVE:** To assess current day practice of lipid control in patients with DM with NCVD vs those with CAD.

**METHODS:** We retrospectively identified 3336 patients with DM and known atherosclerotic vascular disease between January 2009 and March 2012. We compared demographic variables, lipid levels, and statin use in diabetics with CAD alone vs diabetics without CAD but with one or more NCVD.

**RESULTS:** There were 234 patients in DM with NCVD group and 3102 patients in DM with CAD group. The DM with NCVD group had a higher mean total cholesterol (152 ± 40 vs 146 ± 42 mg/dL; $P = .019$) and mean low-density lipoprotein (LDL; 86 ± 35 vs 80 ± 34 mg/dL; $P = .04$) with only 70% of patients achieving LDL of <100 mg/dL (compared with 80% in the DM with CAD group; $P < .001$). Statin use was 100% in CAD vs 75% in NCVD group ($P < .001$). In addition to limited use of more potent statins in the NCVD group, there was also a significantly lower dose of statins used overall.

**CONCLUSION:** Our study demonstrates lower use and less aggressive application of statins among diabetics with NCVD compared with diabetics with CAD, resulting in higher mean LDL and total cholesterol in the NCVD group.



Funding: None.

Conflicts of interest: No conflict of interest for any of the authors.

* Corresponding author. Division of Cardiovascular Diseases, Director of Vascular Medicine Program, Mid America Cardiology, University of Kansas Medical Center and Hospital, 3901 Rainbow Boulevard, MS 4023, Kansas City, KS 66160-4023.

E-mail address: kgupta@kumc.edu

Submitted April 10, 2014. Accepted for publication November 23, 2014.

1933-2874/
http://dx.doi.org/10.1016/j.jacl.2014.11.006

Diabetes mellitus (DM) is a significant health problem in the United States with approximately 25.8 million people carrying the diagnosis.[1] There has been a steady increase in the number of patients with DM over the past decade. Globally, an estimated 366 million people will be diabetic by the year 2030.[2] The proportion of diabetic patients >65 years of age is also expected to increase as the prevalence of diabetes increases.[2] Not only are diabetic patients more vulnerable for the development of atherosclerotic vascular disease but also they are considered to have similar risk of future cardiovascular events as those who have established coronary artery disease (CAD).[3] The third report of the National Cholesterol Education Program Adult Treatment Panel recommended similar treatment goals or strategies for lipid control among patients with DM and CAD. Noncoronary atherosclerotic vascular diseases (NCVDs) including peripheral arterial disease (PAD), abdominal aortic aneurysm (AAA), and symptomatic carotid stenosis (CS) are also considered to be CAD risk equivalents, hence requiring similar risk factor modifications and lipid control strategy as CAD.[3] Diabetic patients with stroke or known CAD and/or PAD have worse outcomes than nondiabetic patients with the same diagnoses.[4–6] Hence, a more aggressive control of low-density lipoprotein (LDL) target is often reasonable for patients with both DM and atherosclerotic vascular disease.

HMG-CoA (3-hydroxy-3-methyl-glutaryl-coenzyme A) reductase inhibitors or statins not only reduce cardiovascular mortality and morbidity[7–9] but also reduce recurrent coronary events and the need for revascularization in the diabetic population.[9] Statin drugs have been shown to offer significant benefits not only to patients with DM and CAD but also in those with NCVD.

Statin drugs improve overall vascular and endothelial function in patients with NCVD.[10,11] In patients with PAD, statins may play a role in reducing vascular inflammation. Statins improve mortality and cardiovascular events in patients with PAD irrespective of revascularization status.[12] Statin therapy is associated with a lower rate of major adverse cardiovascular events and amputation free survival in patients with chronic limb ischemia.[13] Statin therapy is independently associated with improved survival after AAA repair (open or endovascular).[14,15] Among patients with CS, use of statin drugs has been associated with reduction in the number of cerebral microemboli signals detected by transcranial Doppler[16] and also a reduction in overall cardiovascular events.[17]

Despite previously mentioned benefits of statin drugs, prior studies have demonstrated significant underutilization of guideline-directed therapy among patients with CAD risk equivalents (DM, PAD, AAA, and symptomatic CS) in the absence of concomitant CAD.[18] More recent studies have also shown significant undertreatment of PAD patients with statins.[19,20] There are a paucity of data regarding lipid control among diabetics with NCVD. In the present study, we compared lipid control among diabetics with NCVD vs diabetics with CAD.

## Methods

This is a single-center retrospective observational study conducted at the University of Kansas Hospital and Medical Center. The study was approved by the Institutional Review Board at our facility. Electronic medical records from January 2009 to March 2012 were reviewed. Patients who were 18 years of age or older with International Classification of Disease codes (ICD diagnosis codes) of DM with either CAD alone or DM and one or more of PAD, AAA, or CS were identified. Subjects were included in the study only if their lipid profile and medication lists were available in the electronic medical record system. In our institution, blood samples for lipid profile are analyzed on Beckman Coulter AU5800 (AU). Beckman instrument specific calibrators and reagents are used for all assays. Values of the total cholesterol, high-density lipoprotein (HDL), and triglycerides are obtained. LDL value is then calculated by the Friedewald equation: LDL = [total cholesterol − HDL − (triglycerides/5)].

The diabetic study population was subcategorized into either patients with diagnosis of DM and CAD or DM with one or more NCVD (PAD, carotid artery stenosis, or AAA) based on the ICD codes. Although diabetic patients in the NCVD group had one or more of the diagnoses of PAD, AAA, or CS, none of the patients in the DM and CAD groups had any concurrent diagnosis of NCVD. Similarly, none of the patients in the DM with NCVD group had a diagnosis of CAD. Thus, patients who had a diagnosis of both CAD and any of the other NCVDs were not included in the study.

Demographic variables, last lipid profile available, comorbidities, and statin therapy were compared between the 2 groups. The percentage of patients with LDL levels of <100 and <70 mg/dL were compared between the DM and CAD vs DM and NCVD groups. Mean levels of total cholesterol, HDL cholesterol, LDL cholesterol, and triglycerides were also compared between the 2 groups. We identified the statin drugs used and the mean doses utilized for each agent. To compare the various doses of statins used, we converted all statin doses to an equivalent potency unit, based on the comparative efficacy of the statins,[21–23] where 1 potency unit was assumed to be equivalent to 10 mg of simvastatin. For niacin and statin combinations, the potency unit conversion was based on the strength of the statin. The potency unit conversion used for various statin doses are shown in Table 1.

Statistical analysis was performed using the Statistical Package for Social Sciences (version 19.0; SPSS Inc, Chicago, IL). Data were plotted (eg, histograms and spaghetti plots linking variables) to examine for potential outliers before analysis. Summary statistics (eg, mean, standard deviation, minimum, maximum, proportions) were calculated for all variables. Continuous variables were expressed as mean ± standard deviation. For categorical variables, we used proportions, for overall and subgroups. Chi-square test was used to find association between