

ORIGINAL ARTICLE

Risk Factors, Mortality, and Cardiovascular Outcomes in Patients with Type 2 Diabetes

Aidin Rawshani, M.D., Araz Rawshani, M.D., Ph.D., Stefan Franzén, Ph.D., Naveed Sattar, M.D., Ph.D., Björn Eliasson, M.D., Ph.D., Ann-Marie Svensson, Ph.D., Björn Zethelius, M.D., Ph.D., Mervete Miftaraj, M.Sc., Darren K. McGuire, M.D., M.H.Sc., Annika Rosengren, M.D., Ph.D., and Soffia Gudbjörnsdóttir, M.D., Ph.D.

 ABSTRACT

BACKGROUND

Patients with diabetes are at higher risk for death and cardiovascular outcomes than the general population. We investigated whether the excess risk of death and cardiovascular events among patients with type 2 diabetes could be reduced or eliminated.

METHODS

In a cohort study, we included 271,174 patients with type 2 diabetes who were registered in the Swedish National Diabetes Register and matched them with 1,355,870 controls on the basis of age, sex, and county. We assessed patients with diabetes according to age categories and according to the presence of five risk factors (elevated glycosylated hemoglobin level, elevated low-density lipoprotein cholesterol level, albuminuria, smoking, and elevated blood pressure). Cox regression was used to study the excess risk of outcomes (death, acute myocardial infarction, stroke, and hospitalization for heart failure) associated with smoking and the number of variables outside target ranges. We also examined the relationship between various risk factors and cardiovascular outcomes.

RESULTS

The median follow-up among all the study participants was 5.7 years, during which 175,345 deaths occurred. Among patients with type 2 diabetes, the excess risk of outcomes decreased stepwise for each risk-factor variable within the target range. Among patients with diabetes who had all five variables within target ranges, the hazard ratio for death from any cause, as compared with controls, was 1.06 (95% confidence interval [CI], 1.00 to 1.12), the hazard ratio for acute myocardial infarction was 0.84 (95% CI, 0.75 to 0.93), and the hazard ratio for stroke was 0.95 (95% CI, 0.84 to 1.07). The risk of hospitalization for heart failure was consistently higher among patients with diabetes than among controls (hazard ratio, 1.45; 95% CI, 1.34 to 1.57). In patients with type 2 diabetes, a glycosylated hemoglobin level outside the target range was the strongest predictor of stroke and acute myocardial infarction; smoking was the strongest predictor of death.

CONCLUSIONS

Patients with type 2 diabetes who had five risk-factor variables within the target ranges appeared to have little or no excess risk of death, myocardial infarction, or stroke, as compared with the general population. (Funded by the Swedish Association of Local Authorities and Regions and others.)

From the Department of Molecular and Clinical Medicine, Institute of Medicine (Aidin Rawshani, Araz Rawshani, B.E., A. Rosengren, S.G.), and the Health Metrics Unit, Sahlgrenska Academy (S.F.), University of Gothenburg, and the Swedish National Diabetes Register, Center of Registers in Region (Aidin Rawshani, Araz Rawshani, S.F., B.E., A.-M.S., M.M., S.G.), Gothenburg, and the Department of Public Health and Caring Sciences—Geriatrics, Uppsala University, and the Swedish Medical Products Agency, Uppsala (B.Z.) — all in Sweden; the Institute of Cardiovascular and Medical Sciences, University of Glasgow, Glasgow, United Kingdom (N.S.); and the Division of Cardiology, Department of Internal Medicine, University of Texas Southwestern Medical Center, Dallas (D.K.M.). Address reprint requests to Dr. Aidin Rawshani at the Swedish National Diabetes Register Region of Västra Götaland, Medicinaregatan 18G, Gothenburg 413 45, Sweden, or at aidin.rawshani@gu.se.

N Engl J Med 2018;379:633-44.

DOI: 10.1056/NEJMoa1800256

Copyright © 2018 Massachusetts Medical Society.