Clinical and Economic Outcomes in Medication-Adherent and -Nonadherent Patients With Type 2 Diabetes Mellitus in the Republic of Korea

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ABSTRACT

Background: The prevalence and social burden of type 2 diabetes mellitus (T2DM) is increasing. Medication adherence is necessary for positive outcomes in patients with T2DM.

Objective: This study evaluated the association between medication adherence and clinical/economic outcomes in patients with T2DM in the Republic of Korea over a 3-year period.

Methods: This study used data from the Korean National Diabetes Program at 5 hospitals. Medication possession ratios of ≥90% and <90% were used to define adherent and nonadherent groups, respectively. The degree of glycemic control, changes in blood pressure and lipid profiles, and health care costs were compared.

Results: Of the 608 patients, 472 were medication adherent and 136 were nonadherent. The adherent patients displayed improved fasting blood glucose and hemoglobin A_{1c} during the study. Diastolic blood pressure and total cholesterol were lower at 36 months, and lower low-density lipoprotein cholesterol was noted at baseline and 24 months. The total health care costs were $1861, $2060, and $1924, respectively, versus $1617, $1751, and $1602 during the 3-year study period for the adherent group versus the nonadherent group, respectively ($P = 0.316$, 0.627, and 0.172, respectively), whereas the outpatient drug costs were $1143, $1176, and $1162 in the adherent group versus $925, $778, and $914 in the nonadherent group ($P = 0.002$, $P < 0.001$, and $P = 0.001$).

Conclusions: The adherent patients displayed better glycemic control and lipid profiles. Medication-related expenses were higher in the adherent group, but overall health care costs, including hospitalization costs, were similar between the 2 groups. (*Clin Ther.* 2014;36:245–254)

Key words: adherence to medication, clinical and economic outcomes, type 2 diabetes mellitus.

INTRODUCTION

The prevalence of diabetes mellitus (DM) is increasing worldwide. Moreover, DM is a great public health concern. According to the International Diabetes Federation, the global prevalence of DM in 2010 was 6.6%, and is expected to rise to 7.8% by 2030.[1] Nearly 26 million Americans have diabetes (8.3% across all age groups, 11.3% of adults ≥20

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years of age, and 26.9% of adults ≥65 years of age) according to the Centers for Disease Control and Prevention.[2] Moreover, between 2005 and 2008, 35% of US adults ≥20 years of age were prediabetic based on fasting glucose or hemoglobin A_{1c} (HbA_{1c}) levels. The prevalence of DM in the Republic of Korea has increased 6- to 7-fold—from 1.5% to 9.9%—during the past 40 years as life expectancy has increased and western lifestyles have been adopted.[3] Indeed, by 2025 countries such as India and China may have >20 million citizens with DM.[4]

DM is a leading cause of death and a significant source of morbidity and mortality. DM was the 4th-leading cause of death among the elderly in the Republic of Korea in 2010.[5] Moreover, DM was the 7th-leading cause of death in the United States in 2007.[6] Furthermore, the social and individual burden of disease treatment continues to increase. Annually, 19.2% of Korea's national health insurance claims (~3.1853 trillion, or US $3 billion), are associated with DM.[7] Patients with diabetes related microvascular or macrovascular disease pay 4.7- to 10.7-fold more each year than patients without diabetic complications.[8] Medication adherence is crucial for the improvement of clinical outcomes and the reduction of social and individual burdens in patients with DM. The term *adherence* refers to the act of conforming to the recommendations made by the provider with respect to the timing, dosage, and frequency of taking a medication.[9] Nonadherence to medication worsens the disease and creates a greater economic burden on the national medical system.[10,11]

The United Kingdom Prospective Diabetes Study suggested that an HbA_{1c} value of <7%, without significant hypoglycemia, may have small but significant beneficial effects on microvascular outcomes.[12] Previous studies have also shown that increased medication adherence resulted in decreased hospitalization, whereas decreased medication adherence was associated with increased health care services and costs in patients with DM.[10,13,14] Previous studies, however, have not examined the relationship between clinical and economic outcomes and medication adherence over a significant period of time.

The present study was designed to evaluate the association between medication adherence and clinical and economic outcomes in patients with type 2 DM (T2DM) in the Republic of Korea. The primary outcome measures included the glucose control status and changes in blood pressure and lipid levels over a 3-year period. Moreover, annual health care costs per patient according to medication adherence were examined.

METHODS

Study Design and Patients

This prospective cohort study of adult patients with T2DM examined the relationships among adherence with oral hypoglycemic agents (OHAs), clinical outcomes, and health care costs over a 3-year period.

The present study used data from patients with T2DM obtained from a cohort identified from the Korea National Diabetic Program (KNDP) database at 5 hospitals.[15] The KNDP is an ongoing, prospective, large, national-scale cohort study that began in 2005 and includes patients with adult T2DM diagnosed according to American Diabetes Association criteria.[16] The patients enrolled in the study visited 1 of 13 KNDP-affiliated hospitals and received treatments including lifestyle modification, OHAs, and insulin. Baseline characteristics, laboratory data, and diabetic complications were assessed on enrollment and each year during the study.

The KNDP cohort was composed of 2 groups: (1) patients with T2DM and (2) patients at high risk for diabetes. The T2DM cohort was composed of patients who had satisfied the diagnostic criteria set by the American Diabetes Association in 2004 and who were aged ≥20 years. Patients with impaired fasting glucose or impaired glucose tolerance, as well as patients who had met the diagnostic criteria for gestational diabetes, were identified as the subgroup at high risk for diabetes.

Approval for the study was granted by the institutional review board at each of the participating hospitals (Ajou University Hospital, AIJRB-CRO-05-093; Kyung Hee University Hospital, KMC05-26-04; Inha University Hospital, 2006-67; Hanyang University Hospital, 2005-250; Korea University Guro Hospital, GR0542-001; Kyung Hee University Kangdong Hospital, KHNMC IRB 2006-017).

Measures

Independent Variable: Adherence

The medication possession ratio (MPR) was used to assess OHA adherence.[17] The MPR during the 3-year study period was calculated for patients taking any of the following medications: a sulfonylurea, a meglitinide, a biguanide, a thiazolidinedione, an α-glucosidase inhibitor, a dipeptidyl peptidase-4 inhibitor,