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All-cause mortality and its risk factors among type 1 and type 2 diabetes mellitus in a country facing diabetes epidemic

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ABSTRACT

Aim: Diabetes mellitus is associated with an increased risk of premature death mainly secondary to macrovascular and microvascular complications. Mortality data from the Eastern Mediterranean region known for its high diabetes prevalence are lacking. We aimed to assess all-cause mortality and its predictors using large cohort from the Saudi National Diabetes Registry (SNDR).

Methods: The study population comprised of 40,827 individuals with type 1 and type 2 diabetes mellitus aged ⩾25 years registered in SNDR between January 2007 and December 2013. All patients were followed until death, according to the date of death or reaching 100 years of age or end of the study. Death was verified from the national civil affairs database. The general population during the study period was used as a reference for standardized mortality ratio (SMR) calculation.

Results: With a total of 152,038 person-years of follow up, 2582 patients were deceased giving all-cause mortality rate of 16.98 per 1000 person-years and SMR (95% CI) of 1.93 (1.86–2.00). Mortality rates were higher among men and increased with age, while SMR attenuated with increasing age. The independent predictors for all-cause mortality were longer diabetes duration, presence of macrovascular complications, nephropathy, retinopathy, hypertension, male gender and older age, while morbid obesity and the presence of hyperlipidemia were associated with reduced risk.

Conclusions: The unexpectedly low mortality rate in this population would be associated with higher number of deaths as a result of the high prevalence of diabetes and its complications. Reducing the prevalence of diabetes and its complications would reduce the risk of mortality.

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1. Introduction

Although diabetes mellitus is associated with an increased risk of premature death [1], there are no diabetes related mortality data from the Eastern Mediterranean region which is facing a soaring rate of diabetes [2]. Diabetes was ranked the fifth leading cause of death globally [1], wherein the International Diabetes Federation (IDF) estimated that 1 in 12 of global all-cause deaths in adults were attributed to diabetes [3]. There is an increased rate of age-standardized mortality rate for persons with diabetes in developed countries in which the persons with diabetes are twice at increased risk when compared with persons without diabetes [4]. On the other hand, the relative mortality rate among persons with diabetes was found to be higher in the younger age group when compared with the general population [4,5].

Although mortality is one of the key measures for understanding the burden of the disease and its progression, and often used to assign priorities in health interventions [6], the estimation of true mortality rate attributed to diabetes is a real challenge due to the fact that the routinely reported mortality statistics are based on death certificates which would underestimate the impact of diabetes related to these deaths [5]. On the other hand, most of studies that provided realistic estimates of the number of deaths attributable to diabetes have come from western populations [1]. Therefore, since diabetes related mortality data from the Middle East are limited and due to the lack of vital registration systems to estimate cause-specific mortality among diabetic patients in the whole region, the main aim of this study was to determine the all-cause mortality rate and its predictors as well as assessing the standardized mortality ratio (SMR) among patients with diabetes compared with the general population by using the Saudi National Diabetes Registry (SNDR) that hosts a very large diabetic cohort that is linked to the national civil affairs database [7].

2. Methods

2.1. Data source and study population

The cohort of this study consisted of 57,790 persons with diabetes who were selected from the SNDR during the period from 1st January 2007 till 31st December 2013 including: 36,691, registered between 2007 and 2012 as reported in the previous report of the registry [7], 8673 patients registered in 2013 and 12,426 patients audited at institutional and national level. The SNDR is a live and interactive web-based electronic system that hosts all personal and medical data of each patient and is linked to the national civil affairs database that functions as a source of social and life status records.

Patients aged ⩾25 years were selected from this cohort totaling at 55,575 patients. Out of this cohort, patients suffering from impaired glucose tolerance (IGT) (986), gestational diabetes mellitus (GDM) (4691), secondary diabetes (41) and unclassified diabetes (130) were excluded. A total of 49,727 persons with diabetes were screened for the following inclusion criteria: being type1 or type 2 diabetes mellitus based on the American diabetes association (ADA) criteria, having complete clinical, biochemical and management data one year prior to one of the study end points and being registered in the database of the national civil affairs. A total of 40,827 patients who fulfilled the above-mentioned criteria were selected. All patients were followed up to one of the following endpoints: death, according to the date of death, reaching the age of 100 years or end of the follow up by December 31st 2013. Using the national identification number and the patients' full name in addition to their date of birth, life status of the 2582 deceased patients were ascertained from the national civil affairs database (Fig. 1).

2.2. Comparison group

We compared the crude mortality rate for the studied cohort with 8,522,490 citizens aged ⩾25 years from the general population based on the regional census of the Highlight Demographic Survey in 2010, out of which 56,333 persons deceased during that period between 2007 and 2013 thereby providing a crude mortality rate of 6.61 per 1000 persons.

2.3. Diabetes co-morbidities

All clinical data were collected from patients' hospital charts including comorbidities. Neuropathy was considered after the patients presented by numbness, pain or after positive clinical examination using monofilament test. Retinopathy was considered when non-proliferative (NPDR) or proliferative diabetic retinopathy (PDR) were reported. Nephropathy cases were identified when microalbuminuria, macroalbuminuria or end stage renal disease (ESRD) were diagnosed. Patients with history of ischemic heart disease, coronary artery bypass or angioplasty, cerebrovascular accident or peripheral

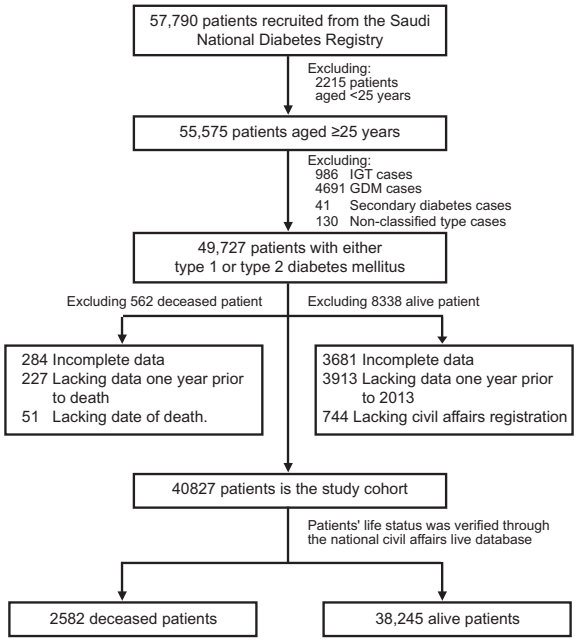

Fig. 1 – Flowchart of the mortality for the selected Saudi National Diabetes Registry cohort followed from January 2007 to December 2013.