Contents available at ScienceDirect

Diabetes Research and Clinical Practice

journal homepage: www.elsevier.com/locate/diabres

International Diabetes Federation

Modeling of in hospital mortality determinants in myocardial infarction patients, with and without type 2 diabetes, undergoing pharmaco-invasive strategy: the first national report using two approaches in Iran

Ali Ahmadi [a,*], *Hamid Soori* [b], *Homeira Sajjadi* [c]

[a] *Department of Epidemiology and Biostatistics, School of Public Health, Shahrekord University of Medical Sciences, Shahrekord, Iran*

[b] *Safety Promotion & Injury Prevention Research Center, Department of Epidemiology, School of Public Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran*

[c] *Community Medicine, Social Determinants of Health Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran*

ARTICLE INFO

Article history:
Received 7 November 2014
Received in revised form
14 January 2015
Accepted 19 February 2015
Available online 1 March 2015

Keywords:
Myocardial infarction
Type 2 diabetes
Mortality
Coronary artery bypass grafting
Percutaneous coronary intervention

ABSTRACT

This study was conducted to compare the characteristics of patients, with and without diabetes mellitus, presenting with myocardial infarction (MI) and treated with coronary artery bypass grafting (CABG), percutaneous coronary intervention (PCI), or thrombolytic therapy. Factors related to mortality due to MI in Iran were also determined. This study was a prospective analysis. To analyze the data, Stata software (chi square, *t* test, Cox and logistic regression) was used. Participants were patients hospitalized for MI for the first time in 540 hospitals from April, 2012 to March, 2013. Out of 20,750 patients with MI, 461 2 (22.3%) had type 2 diabetes. MI case fatality rate was 13.22% (95%CI: 12.24–14.19) and 11.78% (95%CI: 11.28–12.27) in patients with and without diabetes, respectively. The rates of CABG, PCI, and thrombolytic therapy use were 4.2%, 8%, and 58% in patients with diabetes, and 2.1%, 6.5%, and 55% in patients without diabetes. The odds ratio of mortality for ST segment elevation myocardial infarction (STEMI) and chest pain resistant to treatment was, respectively, 6.3 and 2.8 in those with diabetes, and 3.9 and 3.7 in patients without diabetes. The hazard ratio of mortality for gender, education, smoking, left bundle branch block, PCI, and type of MI was different between the two groups ($P < 0.05$). Characteristics of patients dying post MI were different in those with or without diabetes mellitus. Although use of CABG, PCI, and thrombolytic therapy was more frequent in patients with diabetes than without, mortality was higher in diabetes patients.

* *Corresponding author at:* Modeling in Health Research Center, Shahrekord University of Medical Sciences, Shahrekord, Iran. Tel.: +98 383 3333448/+98 913 3834324; fax: +98 383 3334678.
E-mail addresses: aliahmadi2007@gmail.com (A. Ahmadi), hsoori@yahoo.com (H. Soori).

http://dx.doi.org/10.1016/j.diabres.2015.02.018
0168-8227/

1. Introduction

Despite decreases in morbidity and mortality rates due to cardiovascular diseases in most developed countries, these diseases have become the most important health challenge and cause of mortality in many developing countries worldwide, including the Islamic Republic of Iran. Myocardial Infarction (MI) is the leading reason for mortality in this country [1–3]. Type 2 diabetes has an important role in mortality from MI [3–5]. A study in Japan showed that, among patients with MI, diabetes was not an independent predictor of hospital mortality [6]. Type 2 diabetes is one of the most common metabolic disorders in the world. Most people with type 2 diabetes live in low- and middle-income countries and these will experience the greatest increase in cases of diabetes over the next 22 years. [7]. In Iran, type 2 diabetes prevalence varies between 4.2% and 15.9% in general population [8–10]. Diabetes is the 9th and 16th leading reason for death in women and men, respectively in Iran [11,12]. Use of treatments such as coronary artery bypass grafting (CABG), percutaneous coronary intervention (PCI), and thrombolytic therapy has lowered mortality from ischemic heart disease, but these procedures do not lead to similar outputs for all patients [13–15]. In Iran, no study has been yet conducted to compare the characteristics of new MI cases in those with and without diabetes undergoing pharmaco-invasive therapy nor to establish the factors related to mortality from MI. Therefore, the contribution of type 2 diabetes to the risk and outcome of MI remain unspecified in this country and relevant healthcare decisions in Iran's health system are made based on research conducted in other countries [16]. This study was conducted to determine and compare the characteristics of patients with or without diabetes who underwent pharmaco-invasive therapy post MI, and to determine the factors contributing to mortality.

2. Materials and methods

This study was a prospective analysis of data obtained from the Myocardial Infarction Registry of Iran's Cardiovascular Diseases Surveillance System. 20,750 patients hospitalized with a new presentation with MI (across 540 hospitals) between April 2012 to March 2013 were included. The study protocol was approved by the Management Center of Non-Communicable Diseases and Office of Cardiovascular Diseases Prevention of Iran Ministry of Health and Medical Education (approval no. 305/837). Inclusion criteria were based on the World Health Organization (WHO) and World Heart Federation definition of myocardial infarction diagnosis as per the International Classification of Diseases (ICD10) codes I21, I22 [17]. Patients with prior myocardial infarction history or no definite diagnosis by a cardiologist were excluded from the study. Data on age, gender, education, ischemic heart disease symptoms, duration of hospital stay, smoking, dyslipidemia, hypertension, heart failure, and family history of cardiovascular diseases were collected. Confirmation of presence of type 2 diabetes was by fasting blood glucose test and levels of glycosylated hemoglobin (HbA1C) obtained from the patients' medical records. Diabetes was confirmed when fasting plasma glucose (FPG) $\geq$7 mmol/L or when a participant self reported having been diagnosed by a physician and was on medication for type 2 diabetes [9,10,18]. After definite diagnosis of MI by a cardiologist, data on left bundle branch block (LBBB), right bundle branch block (RBBB), atrial fibrillation, ventricular and atrial tachycardia, type and location of MI, and use of therapeutic regimens like CABG, PCI, and thrombolytic therapy were gathered. Hospital mortality from MI was determined as a dependent variable. To analyze the data, chi-square, *t* test, and two regression models were conducted. Odds ratio (OR) and hazard ratio (HR) of death for clinical and demographic risk factors were calculated by logistic regression and Cox regression, respectively. The cohort of patients was defined by the date at MI diagnosis, hospital stay, and follow-up till discharge or death (disease outcome). HR of death was calculated and reported as crude and adjusted rates for those with and without diabetes by seven Cox proportional hazards models. First, univariate analysis was used. To control for confounders, we entered the variables which were significant or approximately significant into a multiple regression model. Stata software (Stata Corp. 2011. Stata Statistical Software: Release 12. College Station, TX: Stata Corp LP) was used and $P < 0.05$ was considered significant.

3. Results

Of 20,750 new MI patients, 4612 had type 2 diabetes. The prevalence of diabetes was thus 22.3% and 58.5% were men. Mean $\pm$ standard deviation of age at the time of MI was 61.9 ± 11.7 and 60.9 ± 13.8 years for those with or without diabetes mellitus, respectively. The mean duration of hospitalization was 6.5 days for all patients and similar for those with or without diabetes ($P > 0.05$). Data on age groups, education, gender, and medical history are shown in Table 1. Out of 2834 type 2 diabetes patients presenting with STEMI, 224 (7.9%) died within a year. MI case fatality rate (CFR) was 13.22% (95%CI: 12.29–14.19) and 11.78% (95%CI: 11.28–12.27), respectively, in those with or without diabetes ($P = 0.008$). 58.4% of patients with type 2 diabetes were between 30 and 64 years old. The prevalence of hypertension was 52.8% and 30.6% in those with or without diabetes, respectively. The prevalence of heart failure was 28.2% in those with type 2 diabetes patients. The prevalence of respiratory distress and vomiting was 6% and 3.3% in those with diabetes and 5.2% and 2.6% in those without diabetes, ($P < 0.05$). No significant difference was seen for other complaints and symptoms prior to MI including sweating, nausea, and jaw pain in those with or without diabetes ($P > 0.05$). The proportion of CABG, PCI, and thrombolytic therapy use was, respectively, 4.2%, 8%, and 58% in those with diabetes and 2.1%, 6.5%, and 55% in those without diabetes. Mortality following PCI and CABG was 7.28% and 15.74% in those with diabetes and 4.72% and 11.4% in those without diabetes. Mortality following the above therapies was significantly higher in those with diabetes without ($P < 0.001$). Mortality following thrombolytic therapy in patients with diabetes was significantly less than in those without (13.23% vs. 15.57%, $P < 0.05$). Comparison of clinical characteristics between the two groups of patients is shown in Table 2. Determinants of mortality were different in multiple