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ORIGINAL ARTICLE

Establishing a risk scoring system for predicting erosive esophagitis

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Summary *Objective:* This study aims to establish a noninvasive scoring system to predict the risk of erosive esophagitis (EE).

Methods: From 2002 to 2009, a total of 34,346 consecutive adults who underwent health check-ups and upper gastrointestinal endoscopy were retrospectively enrolled. Of the participants, 22,892 in the earlier two-thirds period of examination were defined as the training set and the remaining 11,454 as the validation set. EE was diagnosed by upper gastrointestinal endoscopy. Independent risk factors associated with EE were analyzed by multivariate analysis using a logistic regression model with the forward stepwise selection procedure in the training set. Subsequently, an EE risk scoring system was established and weighted by β coefficient. This risk scoring system was further validated in the validation set.

Results: In the training set, older age, male gender, higher body mass index, higher waist circumference, higher serum triglyceride, and lower high-density lipid cholesterol levels were independent risk factors for predicting EE. According to the β coefficient value of each independent risk factor, the total score ranging from 0 to 10 was established, and then low- (0—3), moderate- (4—6), and high-risk (7—10) groups were identified. In the validation set, the

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prevalence rates of EE in the low-, moderate-, and high-risk groups were 5.15%, 15.76% and 26.11%, respectively ($p < 0.001$).

Conclusion: This simple noninvasive risk scoring system, including factors of age, gender, body mass index, waist circumference, triglyceride, and high-density lipid cholesterol, effectively predicted EE and stratified its incidence.

Introduction

The incidence of gastroesophageal reflux esophagitis (GERD) is increasing worldwide [1,2]. The symptoms of GERD include heart burn, regurgitation, and abdominal pain with a decreased quality of life [3], which result in a growing burden for health care systems and employers [1]. Moreover, it may develop serious complications such as esophageal adenocarcinoma [1]. Consequently, GERD has become an important health care challenge.

The risk factors of GERD are not fully identified till now. Recent studies demonstrate that GERD and erosive esophagitis (EE) are associated with metabolic syndromes, including central obesity and increased waist circumference (WC) [4,5]. Moreover, lipid profiles of the metabolic syndromes have also been demonstrated as independent risk factors for GERD [4]. Some studies have proposed that the increasing trend of GERD in the recent decades may be partly explained by an increasing body mass index (BMI) of the general population and a higher prevalence of metabolic syndrome worldwide [6,7]. Besides metabolic syndromes, whether other epidemiologic risk factors are associated with GERD and EE is still under debate [2,8]. For example, the impact of age and sex on GERD has been shown to be different between Japan and Western countries [9].

It is crucial to identify the risk factors for predicting GERD and EE, which may be benefit for disease control, and for the target of lifestyle modification and medical therapies. The aim of the present study, therefore, was to investigate the risk factors for EE and establish a noninvasive scoring system to predict its incidence.

Materials and methods

Patients

Patients who completed the health check-up service at the Health Management Center of Taipei Veterans General Hospital, Taipei, Taiwan from 2002 to 2009 were considered for enrollment. As gastric cancer is an important cause of cancer mortality in Taiwan, esophagogastroduodenoscopy (EGD) is a routine examination in our physical check-up service. The demographic data including age, sex, BMI, WC, and blood pressure (BP) were recorded. Patients who did not have the data of EGD and all the parameters for the study during health check-up were excluded. Finally,

34,346 consecutive and eligible patients were enrolled for analysis.

According to the revised National Cholesterol Education Program-Adult Treatment Panel III criteria, BMI was calculated by dividing the body weight (in kilograms) by the square of the patient's height (in meters), and obesity was defined as BMI ≥ 25 kg/m^2 [10,11]. The upper limits of WC were 90 cm for men and 80 cm for women. BP was measured after the examinees had been seated for > 5 minutes. Systolic BP (SBP) and diastolic BP (DBP) were recorded as the means of three consecutive readings with a difference in the SBP of < 10 mmHg. The upper limits of SBP and DBP were 130 mmHg and 85 mmHg, respectively.

This study complied with the standards of the Declaration of Helsinki and current ethical guidelines. It was approved by the Institutional Review Board of Taipei Veterans General Hospital (No. 2011-08-010IC).

Biochemical and serologic markers

Venous blood samples were collected after overnight fasting. Serum biochemical tests were measured using Roche/Hitachi Modular Analytics Systems (Roche Diagnostics GmbH, Mannheim, Germany). The reference limits of these tests were as follows: alanine transaminase (ALT) level, 40 IU/L; total cholesterol level, 200 mg/dL; high-density lipoprotein-cholesterol (HDL-C) level, 40 mg/dL in men and 50 mg/dL in women; low-density lipoprotein-cholesterol level, 130 mg/dL; triglyceride (TG) level, 150 mg/dL; fasting glucose level, 100 mg/dL; and 2-hour postload plasma glucose level, 150 mg/dL.

Endoscopic findings

Eleven experienced endoscopists performed the EGD procedures and recorded the findings on a digital file system. EE was diagnosed according to the Los Angles criteria by two senior endoscopists (Y.-J.W. and J.-C.L., both had performed more than 5000 EGD procedures) [12]. If the diagnosis for the same patient was inconsistent between these two doctors, the digital file was reviewed again to reach a consensus.

Statistical analysis

To establish and validate a risk scoring system to predict EE, we divided our study cohort into model derivation (training)