論 文 要 旨

Development of Predictive Equation and Score for 5-Year Metabolic Syndrome Incidence in Japanese Adults

日本人成人における５年後のメタボリックシンドローム発症の予測式
およびスコアの作成

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【Introduction】

Metabolic syndrome (MetS) develops from underlying risk factors mainly abdominal obesity and insulin resistance. The global prevalence of MetS is around 20-25% and that of Japan is 19.3%．MetS is contributing to the increased risk of developing atherosclerotic cardiovascular diseases and increased cardiovascular disease (CVD) morbidity and mortality. Predicting MetS is important for identifying high-risk individuals and providing preventive interventions. However, MetS prevalence and CVD risk associated with MetS depend on ethnic variation and the MetS definition used. The Japanese criteria for MetS differ from other available guidelines such as the World Health Organization, International Diabetes Federation, National Cholesterol Education Program Adult Treatment Panel-III, and American Heart Association/National Heart, Lung, and Blood Institute, by including waist circumference (WC) as an essential component, with unique WC cut-off points. The optimal WC obtained from computed tomography scans indicates a visceral fat area of 100 cm^2 at the navel level is equivalent to a WC of $\geq$ 85 cm for men and $\geq$ 90 cm for women in Japan. Furthermore, risk prediction models are becoming more prevalent in healthcare practice due to their increasing importance in early disease detection, intervention, and decision-making. Although previous reports develop MetS prognostic models for different populations the majority lacked validation, were cross-sectional studies, had a smaller sample size, did not involve lifestyle factors, and none used Japanese criteria for MetS. Therefore, the current study aimed to determine independent predictors of MetS, develop and validate an equation, and develop a simple prognostic model for 5-year MetS risk in adult Japanese population using Japanese MetS criteria.

【Methods】

We analyzed the health check-up data of 198,292 individuals from Kagoshima Kouseirin Hospital from October 2008 to March 2019. We included participants aged 30-69 years, with 5-year follow-up data, and excluded all participants with MetS at baseline. We remained with 54, 198 participants (mean [±SD] age, 54.5 ± 10.1 years; men, 46%）who were randomly assigned in a ratio of 2:1 to derivation cohort, used to develop a risk score for MetS and validation cohort, used to evaluate the validity of the score. Multivariate logistic regression analysis was performed in derivation cohort and scores were assigned to factors corresponding to beta coefficients. We evaluated predictive ability of the scores using the area under the curve (AUC), then applied them to validation cohort to assess reproducibility. The outcome was MetS incidence after 5-years of follow-up.

【Results】

After 5-year follow-up a total of 2,326 (6.4%) and 1,216 (6.7%) participants in derivation and validation cohorts developed MetS, respectively. The primary model ranged from 0–27 points and had an AUC of 0.81 (sensitivity: 0.81, specificity: 0.81, cut-off score: 14), and consisted of age, sex, blood pressure (BP), body mass index (BMI), serum lipids, glucose measurements, tobacco smoking, and alcohol consumption. The simplified model (excluding blood tests) ranged from 0–17 points with an AUC of 0.78 (sensitivity: 0.83, specificity: 0.77, cut-off score: 15) and included: age, men, systolic BP, diastolic BP, BMI, tobacco smoking, and alcohol consumption. We classified individuals with a score of <15 and ≥15 points as low- and high-risk MetS, respectively. Furthermore, the equation model generated an AUC of 0.85 (sensitivity: 0.86, specificity: 0.55). Analysis of the validation and derivation cohorts yielded similar results.

【Discussion and Conclusion】

The present study created and validated an equation and a simple prognostic model for the 5-year risk of MetS in the general Japanese population. From the primary model that included blood sampling variables, we found 11 independent predictors of MetS, consisting of age, sex, SBP, DBP, BMI, TG, LDL-C, HDL-C, FPG, tobacco smoking, and alcohol consumption. The primary model was useful (AUC, 0.81) for predicting MetS. Similarly, the simplified model with excluded blood variables showed acceptable discrimination (AUC, 0.78) in predicting MetS. The continuous equation model had excellent predictive ability (AUC, 0.85) for MetS. In addition, the incidence of MetS gradually and simultaneously increased as the score increased in both derivation and validation cohorts. We recommend the application of simplified prediction score in clinical settings because it is easier to use with similar predictive ability as the primary model and has only seven variables that do not require the results of blood sampling. The equation model can be used for the near future generation of MetS screening software applications. To our knowledge, this is the first study to create an equation and a simplified prognostic score based on the Japanese MetS definition criteria to predict the 5-year risk of MetS.