Development and validation of a predictive model for the risk of sarcopenia in patients with COPD

Zhenjie Yu

City University of Hong Kong

Background

Chronic obstructive pulmonary disease (COPD) is a heterogeneous, complex, and multisystem disease characterized by numerous intra- and extrapulmonary manifestations. COPD can lead to changes in body composition, reduced levels of physical activity, and a reduction in muscle mass or strength; these are common manifestations of COPD that adversely affect prognosis. The presence of these factors is closely associated with sarcopenia, defined as a progressive and generalized skeletal muscle disorder characterized by the accelerated loss of muscle mass and function. In patients with COPD, sarcopenia is characterized by a high incidence and severe adverse consequences, significantly jeopardizing their physical function and quality of life. However, because of the lack of a unified diagnostic protocol and the insidious onset of pre-sarcopenia symptoms result in most cases being diagnosed at a late stage. Thus, early risk factor management and targeted nursing are crucial for patients with COPD to prevent sarcopenia. However, a consensus regarding these factors among patients with COPD remains unattainable. This is primarily attributed to the lack of a standardized definition for sarcopenia and the non-uniformity of diagnostic tools, resulting in varying prevalence rates. The inconsistency in research quality and scope and the diversity of sampling strategies intensify these discrepancies.

AIM

This study aimed to investigate the factors influencing sarcopenia in patients with COPD and construct a related risk prediction model to provide more substantial evidence for managing sarcopenia in patients with COPD.

Methods

This study continuously recruited 268 patients with COPD in Tianjin, China, from June 2022 to December 2023. Participants were included if they met the 2022 GOLD diagnostic criteria for COPD, were conscious and able to communicate, and provided informed consent. Exclusion criteria included a prior diagnosis of sarcopenia, use of medications affecting body composition, inability to perform tests, or communication difficulties.1.0 quantiles. The comparison between both subset and full dataset allows to identify conserved or split structures, depending on the overlaps of original cluster cells with the second set's clustering. If one matching cluster exists for > 75% of the original cluster's cells in the projected dataset, we call this cluster "conserved"; if the two best-matching.

The study evaluated several factors, including sarcopenia, medical coping modes, nutritional status and self management skills. The data was randomly split into a 70% training set and a 30% validation set using R software. Univariate analysis identified potential risk factors, and multivariate logistic regression was used to confirm independent risk factors (P < .05) for sarcopenia. A nomogram was then developed to visualize the risk prediction model.

Results

The final sample included 268 COPD patients, with a mean age of 71.49 years and a sarcopenia prevalence of 31.81%. The data were split into a training set (n=189) and a validation set (n=79) with no significant demographic differences between them.

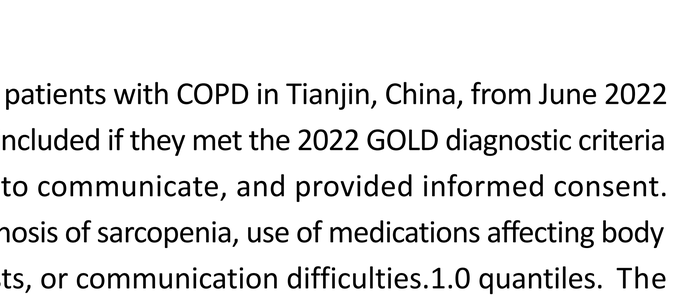

Fig.1. Nomogram

Further multivariate logistic regression analyses revealed that history of alcohol consumption, BMI, mMRC, and medical coping modes were independent risk factors for sarcopenia in the training set.

Based on these factors, a nomogram was developed to predict the individual risk of sarcopenia(Figure 1).

The model showed good discrimination, with an Area Under the Curve (AUC) of 0.948 in the training set and 0.915 in the validation set. Both C-indexes were well above 0.70, indicating a strong ability to distinguish between patients with and without sarcopenia (Figures 2 and 3).

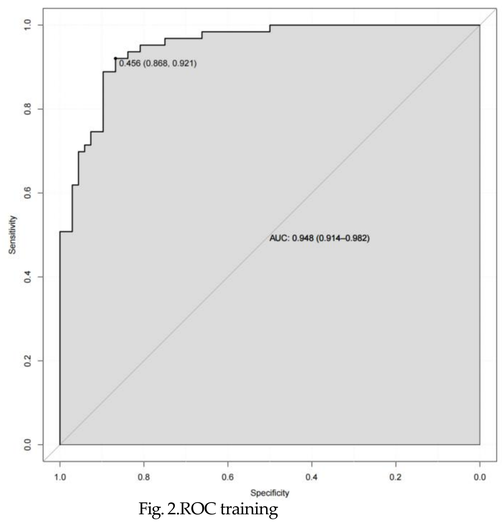

Fig. 2.ROC training

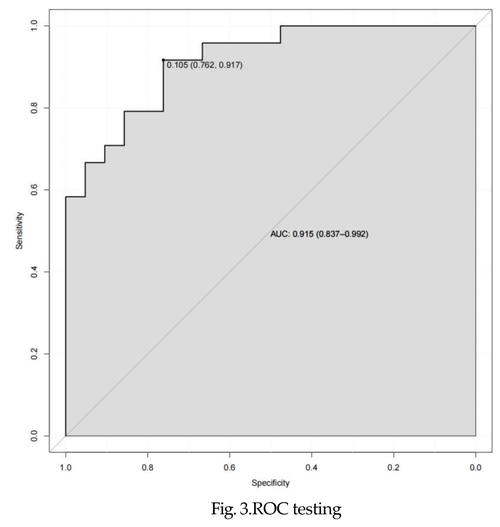

Fig. 3.ROC testing

The calibration curves showed strong agreement between the predicted risks and actual outcomes. The Hosmer-Lemeshow test was not significant in either set (P > 0.05), confirming the model's high calibration ability (Figures 4 and 5).

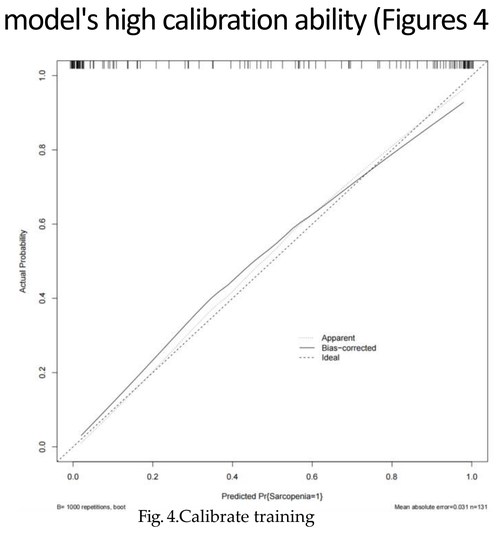

Fig. 4.Calibrate training

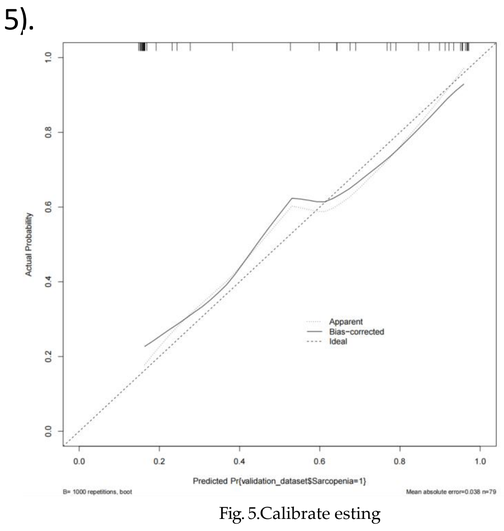

Fig. 5.Calibrate esting

Decision curve analysis revealed the good clinical application value of this model (Figures 6 and 7).

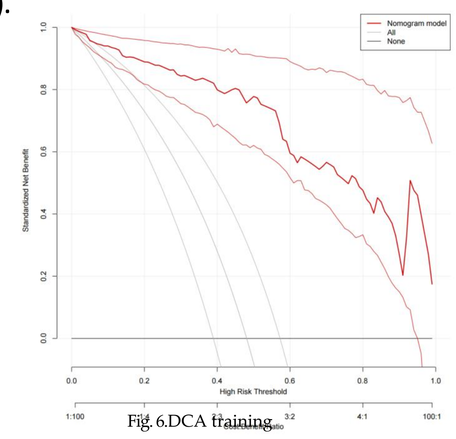

Fig. 6.DCA training

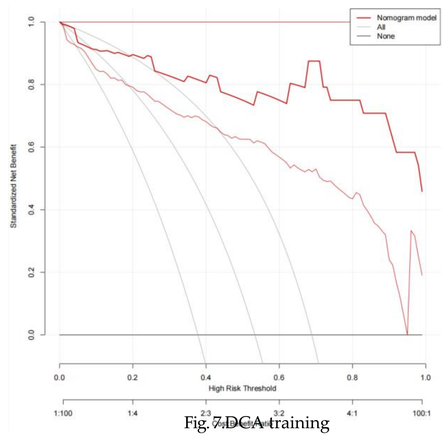

Fig. 7.DCA training

Discussion

This study found a sarcopenia prevalence of 31.81% in COPD patients, a rate slightly higher than previous findings, potentially due to the post-pandemic timing of the research, the severity of illness in hospitalized participants, and reduced physical activity during winter.

Higher BMI: Mildly overweight status may be beneficial, possibly due to hormones secreted by fat tissue that protect muscle metabolism.

Abstinence from Alcohol: Chronic alcohol use can impair muscle cell function and lead to metabolic abnormalities, while quitting can reverse insulin resistance and improve muscle protein synthesis.

Positive Medical Coping Style: Patients with a positive attitude are more likely to adopt healthy lifestyles and engage in activities that reduce sarcopenia risk.

Lower mMRC Scores: Better respiratory function, indicated by lower mMRC scores, correlates with higher physical activity levels, which is crucial for maintaining muscle integrity.

Conclusion

This study provides a reliable tool using four factors: alcohol consumption history, BMI, mMRC, and medical coping strategies. Limitations include potential bias from subjective scales and self-reported data. The single-center design limits generalizability, requiring future large-scale cohort studies for verification.