

Synergistic Effect of the Triglyceride-glucose Index and RAR for Mortality in Patients with Type 2 Diabetes Mellitus

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Abstract

Background: The triglyceride–glucose (TyG) index is closely linked to chronic low-grade inflammation, and the red cell distribution width to albumin ratio (RAR) has emerged as a novel marker of inflammatory and nutritional status. This study examined whether TyG and RAR jointly influence mortality in patients with type 2 diabetes mellitus (T2DM), and further evaluated whether a newly developed composite index, TyG-RAR, provides superior prognostic value compared with conventional TyG-derived obesity indices. **Methods:** The data we analyzed were obtained from 3,799 T2DM patients enrolled in the National Health and Nutrition Examination Survey (NHANES) from 2001–2018. Cox proportional hazards models and restricted cubic spline analyses were applied to assess the associations of TyG and RAR with mortality. Predictive performance was compared via receiver operating characteristic (ROC) curve analyses. Mediation analysis was used to explore the potential mediator. **Results:** During a median follow-up of 85 months, 950 all-cause deaths and 323 cardiovascular deaths occurred. Both TyG and RAR were independently associated with mortality. TyG and RAR exhibit a synergistic effect, patients with concomitantly high TyG and high RAR values presented the greatest risk (all-cause mortality: HR: 2.42, 95%CI: 1.80–3.25; cardiovascular mortality: HR: 3.65, 95%CI: 2.28–5.84). The newly indicator TyG-RAR is significantly associated with the risk of all-cause mortality and cardiovascular mortality. Specifically, compared to the lowest quartile group, the risk of all-cause mortality increased by 157% in the highest quartile group, and cardiovascular mortality by 181%. Compared to other TyG-related indices, TyG-RAR demonstrated superior predictive performance for all-cause mortality (AUC=0.819, NRI=0.183, IDI=0.025) and cardiovascular mortality (AUC=0.850, NRI=0.210, IDI=0.023). C-reactive protein partially mediated the effect of TyG-RAR on all-cause mortality and cardiovascular mortality. **Conclusions:** The TyG index and RAR have synergistic effects on mortality in patients with type 2 diabetes mellitus (T2DM). The composite TyG-RAR index is not only significantly associated with mortality but also outperforms established TyG-derived measures. These findings support the use of the TyG-RAR as a more effective tool for mortality risk stratification in T2DM patients.

Keywords

Triglyceride–glucose Index, Red Cell Distribution Width to Albumin Ratio, All-cause Mortality, Cardiovascular Mortality, Type 2 Diabetes Mellitus