The use of risk scores for stratification of acute coronary syndrome patients

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Although patients with acute coronary syndrome (ACS) share key pathophysiological mechanisms, they present with diverse clinical, electrocardiographic and enzyme characteristics and experience a wide range of serious cardiovascular outcomes. Estimated risk based on clinical characteristics is challenging and imprecise because pain of atypical distribution may herald acute infarction, and up to a third of those who evolve myocardial infarction (MI) do not have typical chest pains,[1] while fewer than half of the patients who are admitted with chest pain have a final diagnosis of ACS. When using electrocardiogram (ECG), ST elevation has high specificity but low sensitivity for infarction and three-quarters of those with ACS do not have ST elevation on presentation.[2] As for troponin, its predictive value on arrival is poor because of the time required for efflux of this marker from cardiomyocytes.[3] Regulatory authorities such as the National Institute for Health and Clinical Excellence (NICE) and guideline groups (American College of Cardiology/American Heart Association [ACC/AHA] and European Society of Cardiology [ESC]) recommend treatments according to specific clinical and risk grouping, and trials show that certain benefits may be predominantly or exclusively restricted to higher-risk patients.[4-6] A new study has found that cardiac catheterisation is not being used optimally in non-ST-elevation (NSTE) ACS patients, mainly because doctors are not risk stratifying these patients correctly.[7] Physicians may be focusing on only one or two risk factors (such as ST-segment depression or troponin status) when risk stratifying patients, while potentially underestimating and/or de-emphasising other important factors (such as increasing age, heart failure and poor renal function). The present article will focus on the different risk scores used in ACS patients for initial risk assessment.

Risk scores

Numerous risk scores[8-12] have been developed but only a few of them have been used in practice. The most popular are the Platelet glycoprotein IIb/IIIa in Unstable angina: Receptor Suppression Using Integrilin Therapy (PURSUIT RS)[10] and Thrombolysis in Myocardial Infarction risk scores (TIMI RS),[11] both derived from clinical trial populations, and the Global Registry of Acute Cardiac Events risk score (GRACE RS),[12] which was developed from an international registry.

The TIMI RS[11] variables were age 65 years or older, at least three risk factors for coronary artery disease, prior coronary artery stenosis of 50% or more, ST-segment deviation on ECG at presentation, at least two anginal events in prior 24 hours, use of aspirin in prior seven days, and elevated serum cardiac markers. Event rates increased significantly as the TIMI risk score increased in the test cohort in TIMI 11B.

The PURSUIT RS[10] predicts 30-day risk and incorporates information from early vital signs (range 0–25). It comprises of age, gender, worst Canadian Cardiovascular Society (CCS) angina class in previous six weeks, heart rate, systolic blood pressure, signs of heart failure, and ST-depression. The combination of death and (re-)infarction yielded similar predictors, with the exception that male gender was a more important predictor of the composite end point, but older age remained the most important predictor.

The GRACE model for calculating the risk for all-cause mortality or new MI across the spectrum of ACS was developed and validated in cohorts from the GRACE registry. The components of the GRACE RS (range 1–372) are age, heart rate, systolic blood pressure, Killip class, cardiac arrest, serum creatinine, ST-segment deviation, and cardiac biomarker status. A prognostic model that predicts the risk of death and MI has been established (C-statistic index 0.84 for death).[13] In the GRACE registry[12] and randomised studies,[14,15] renal impairment has been shown to independently predict higher in-hospital[16] and short-term mortality after an ACS, regardless of the ACS subset. The GRACE algorithm not only includes renal

impairment, but also takes it as a continuous variable like age, heart rate, or blood pressure, allowing more refined prognostic prediction.

Discussion

The most useful risk score will not only provide information on the future risks of death, but also the risks of MI. The latter may be potentially amenable to antithrombotic and revascularisation strategies during the index hospitalisation, whereas the former may be ameliorated by secondary prevention measures. In the study by Van de Werf *et al.*[17] of patients enrolled in the GRACE database, patients admitted to hospitals with catheterisation facilities were more likely to undergo intervention than were patients admitted to sites without such facilities, but they had a higher risk of death within six months of discharge. This later risk may reflect hazards of intervention among low-risk patients. The randomised trial evidence and the guidelines support the use of revascularisation in moderate- or high-risk patients, irrespective of the presence of on-site catheterisation facilities.

Most of the multi-variable prognostic models were derived from clinical trial databases or specific subgroups of patients with ACS. Patients with complications and co-morbidity tend to be excluded from such trials, thus limiting their applicability. In contrast, the GRACE registry spans the spectrum of ACS and is based on an unselected contemporary population. An independent study suggests that the unselected GRACE mortality model is superior to either the TIMI or the PURSUIT models.[18] A number of reasons may account for the differences in discriminatory capacities of TIMI RS, PURSUIT RS, and GRACE RS. Although advanced age, ST-segment deviation, and biomarker status are common components of all three risk scores, PURSUIT RS and GRACE RS also incorporate haemodynamic variables, whereas renal dysfunction is only included in GRACE RS. These clinical characteristics, which have been shown to be powerful independent prognosticators,[19,20] were not evaluated as candidate variables when TIMI RS was initially developed.[11] Exclusion of patients with these high-risk features from clinical trials might also have diminished the prognostic significance of these variables, which were, therefore, eliminated during model development. Furthermore, the TIMI RS composed of dichotomous variables only, and with a limited range of 0–7, likely incurred a trade-off between its ease of use and predictive accuracy. GRACE RS and PURSUIT RS were better than the TIMI RS[17] in predicting death/MI. However, due to the complexity of PURSUIT RS, it is less favoured among physicians, and has not gained much popularity.

Conclusion

Risk scores are simple prognostication schemes that categorise a patient's risk of death and ischaemic events. The ideal score for risk stratification on admission for ACS patients should have a good balance between complexity and utility. When the scores include continuous variables such as age, heart rate, and serum creatinine they are more powerful, but also more complex to calculate. However, personal digital assistant (PDA) applications have significantly simplified these complex calculations. Their use can help tailor our therapies to match the intensity of the patient's ACS. Using the GRACE RS, one could calculate more precisely the risk and the associated mortality rate that would be occurring as compared with other risk scores. High-risk patients will benefit more from very early invasive strategy, while low-risk patients can be spared potentially harmful treatment. The GRACE RS is more advantageous and easier to use in comparison with other available risk scores, hence, we suggest using GRACE RS in the daily risk assessment of ACS patients can only help us. However, it should be emphasised that risk scores are clinical tools that can supplement, but do not replace, sound clinical judgement

Conflict of interest

None declared.

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