SCIENTIFIC LETTER

TIMI risk score accurately risk stratifies patients with undifferentiated chest pain presenting to an emergency department

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The TIMI (Thrombolysis in Myocardial Infarction) trialists developed a score to predict adverse outcomes in patients with unstable angina[1]. The score was validated among patients admitted to specialist cardiological services, a group who are likely to be at higher risk of significant cardiac events than those presenting to an emergency department. The objectives of this study were to determine the relationship between TIMI score and outcomes in an undifferentiated chest pain population and to define the validity of the score without the troponin component, the ''front door'' score.

PARTICIPANTS AND METHODS

The study took place in a single urban teaching hospital emergency department with 85 000 adult attendances yearly. One thousand consecutive patients presenting with potentially cardiac chest pain were enrolled. Exclusion criteria were age less than 20 years and the initial assessing clinician's judgement that chest pain was of a non-cardiac nature. Several variables were determined and recorded on a structured form. Patients were followed up to hospital discharge or 30 days after enrolment.

TIMI scores were then calculated for each patient. The TIMI score consists of seven elements, each scoring one point. The elements are age $\geqslant$ 65 years, three or more risk factors for coronary artery disease, known coronary artery stenosis, use of aspirin for the past seven days or more, raised cardiac markers, $\geqslant$ 0.5 mm deviation of the ST segment on ECG, and two or more episodes of angina in the past 24 h. A front door score was also calculated by removing the cardiac marker element from the TIMI score. The first ECG was used to calculate scores. Owing to small numbers TIMI score groups 6 and 7 were amalgamated in keeping with the original paper.[1]

Outcomes of interest were ST elevation myocardial infarction and troponin-positive acute coronary syndrome not diagnosed at presentation, angioplasty, all cause mortality at 30 days, and readmission within 30 days with myocardial infarction. Combining these outcomes gave a single measure: the 30-day major cardiac event rate. Presentation myocardial infarction was defined for patients presenting to the emergency department with two or more of characteristic pain, ST elevation or positive markers.

The Kruskal–Wallis analysis of variance was used to compare risks of outcome events between each score value group. The front door and TIMI scores were compared by calculation and comparison of receiver operating characteristic curves (area under the curve) (Excel, Microsoft, Redmond, Washington, USA, and Analyse-it V.1.71, Analyse-It Software, Leeds, UK) The requirement for ethical approval was waived by the local research ethics committee.

RESULTS

The 1000 eligible patients were recruited over 75 days. Data were available for analysis for 980 patients. Twenty six patients were excluded, as outcome data were incomplete. Thirty eight patients had a myocardial infarction or troponin-positive acute coronary syndrome at presentation. The median age was 60 years (range 20–95, mean 59 years) and 62% were men. One hundred and thirty-seven (14%) had an outcome event. Outcomes identified were ST elevation myocardial infarction (n = 41), troponin-positive acute coronary syndrome (n = 76), angioplasty (n = 31), all cause death within 30 days (n = 16) and readmission with myocardial infarction within 30 days (n = 1, initial TIMI and front door score 2). Twenty eight patients had multiple outcomes. Table 1 describes the relationship between the TIMI and front door scores and the outcome.

DISCUSSION

This is the first UK study to identify a clear relationship between the TIMI and front door TIMI scores and the risk of significant cardiac events and 30-day mortality in an undifferentiated chest pain population. Several North American abstracts have reported a similar relationship, regarding TIMI scores only, in undifferentiated chest pain populations.[2 3] The front door score is a new measure and, although not as sensitive or specific as the full score, it retains the ability to risk stratify this population. The event rate of 14% is higher than the rate reported from US studies (7–10%),[2 3] which may reflect the higher rates of coronary vascular disease in the Scottish population or other differences in the presenting populations.

The risk stratification provided by the scores can inform triage decisions. Patients with low scores (0 or 1) are at low risk of events. They may potentially be safely discharged after measurement of an early cardiac marker, for example, 6 h troponin, combined with a period of observation or management in a chest pain unit.[4] This can reduce length of stay for some patients. In this study 232 (24%) low-risk patients were admitted for 12 h troponin estimation.

Patients with TIMI scores of $\geqslant$ 5 have a 57% event rate. These patients should be targeted for early aggressive treatment with antithrombotic drugs and direct triage from the emergency department to specialist cardiology services. More than 55% of high-risk patients in this study were admitted to general beds without cardiac monitoring.

The management of patients with intermediate scores (2, 3 or 4) is less clear but may include 12 h troponin measurement and, if appropriate, early provocative testing.

The front door score may have several clinical uses. The score is rapidly obtainable on patient arrival and appears reproducible, although this aspect requires formal evaluation. In common with the TIMI score it clearly identifies risk and can inform triage decisions before the results of troponin assays are available.

This study has several strengths. It is derived from a large consecutive sample of patients with truly undifferentiated chest pain and so the results are likely to be applicable to other general settings. The data completeness (95%) and follow up rate (90%) are high. One potential weakness is that

Table 1 Relationship between TIMI and ''front door'' scores

TIMI score	Total in score group	Number of patients with events (% event rate, 95% CI)*	Front door score	Total in score group	Number of patients with events (% event rate, 95% CI)*
0	231	0 (0%, 0 to 1.5)	0	244	13 (5%, 3 to 9)
1	215	15 (7%, 4 to 11)	1	219	17 (8%, 5 to 12)
2	184	24 (13%, 9 to 18)	2	195	32 (16%,12 to 22)
3	167	40 (24%, 18 to 31)	3	163	35 (21%, 16 to 28)
4	96	23 (24%, 17 to 33)	4	90	20 (22%, 15 to 32)
5	39	19 (49%, 34 to 68)	5	32	13 (41%, 25 to 58)
6/7	22	16 (72%, 52 to 86)	6	11	7 (64%, 35 to 85)
ROC AUC	0.79	95% CI 0.75 to 0.84	ROC AUC	0.70	95% CI 0.65 to 0.75

*Significant at <0.01 by Kruskal–Wallis.
AUC, area under the curve; ROC, receiver operating characteristic; TIMI, Thrombolysis in Myocardial Infarction.

outcome definitions relied on discharge diagnosis as recorded in the medical records rather than by explicit prospective follow up. Among those patients who did not achieve a study end point there may well be a group with unrecognised ischaemic heart disease.

Further prospective research is needed to determine the additional value of adding presentation cardiac markers to the front door score to enhance risk stratification. Triage decisions based on these scores should be prospectively validated and would be of particular interest with respect to patients with low and intermediate risk scoring.

In conclusion, the TIMI score has the potential to improve the management of patients presenting to hospital with undifferentiated chest pain where ischaemic heart disease is a potential diagnosis.

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IMAGES IN CARDIOLOGY

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Concomitant aortic and mitral regurgitations: a rare echocardiographic view

A 62-year-old man was admitted for slight dyspnoea and progressive exercise intolerance. Significant cardiac findings were a proto-meso-diastolic murmur (2–3/6 Levine's scale) at the second intercostal space on the left sternal border and a proto-meso-systolic murmur (3/6 Levine's scale) at the cardiac apex.

Transthoracic colour Doppler echocardiography showed a moderate mitral regurgitation (starting in the end-diastolic phase) and a moderate aortic regurgitation (see panel). This echocardiographic view of concomitant (because they temporarily overlapped) mitral and aortic regurgitations (in the end-diastolic phase) is rare, and is due to an abnormally high end-diastolic left ventricular filling pressure (in this patient depending on the haemodynamically significant aortic regurgitation).

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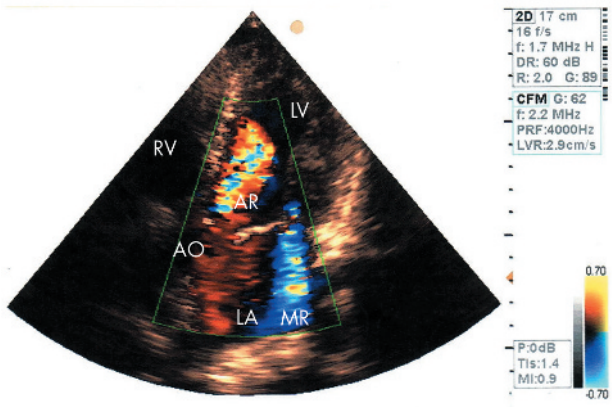

Transthoracic apical five-chamber colour Doppler echocardiographic view showing concomitant mitral and aortic regurgitations (at the end of the diastolic phase). AO, aorta; AR, aortic regurgitation; LA, left atrium; LV, left ventricle; RV, right ventricle; MR, mitral regurgitation.