It's tough to make predictions...

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"It's tough to make predictions, especially about the future."(1)

Yogi Berra knew the score. Sadly, despite all the wonderful advances of our technological era, making predictions remains tough. Although Yogi was speaking about baseball, he could well have been describing the dilemma faced by physicians dealing with cases of chest discomfort, the second most common reason (after abdominal pain) for an emergency department (ED) visit in North America. These physicians are expected to make the correct diagnosis and then predict the future. Is this a presentation of an acute coronary syndrome (ACS)? What is the risk of death or myocardial infarction (MI)? What is the risk of recurrent ischemic events and their complications? Only by predicting risk can decisions be made about investigations and treatment, admission to hospital or discharge home. Physicians assessing patients with chest discomfort must therefore develop skills in risk assessment and risk management to ensure the best care for each patient.

Patients presenting to hospital with chest discomfort undergo a triage assessment based on risk. Simply put, the goal is to admit everyone with an ACS and discharge everyone else for further investigations, as necessary, as outpatients. We are all aware that 'simply put' does not necessarily mean 'simply done'!

An earlier approach was to admit most, if not all, patients with chest discomfort and a reasonable suspicion of myocardial ischemia, and discharge those few who were clearly 'not cardiac'. This resulted in large numbers of admissions that required several days in hospital to 'rule out MI'. With a significant proportion of such patients subsequently shown not to have cardiac disease, this was a costly, inefficient practice (2,3). In addition, too many of those 'not cardiac' patients went on to have early, acute ischemic events. It has been suggested that the coronary care unit admission is appropriate for those patients with a probability of an acute MI of 20% or greater (4,5).

Attempts at improving the accuracy of triage of patients with chest discomfort have resulted in a number of clinical risk scores based on clinical presentation, electrocardiogram (ECG) findings, known cardiac risk factors, age, sex, medications, etc. The use of such scores has been shown to improve with physician 'judgment', especially among the less experienced physicians (6). More recently, the addition of sensitive and specific serum markers of myocardial injury, particularly troponin assays, have significantly enhanced the accuracy of such risk scores. However, even 'troponin-negative' patients have been shown to have a continued small but significant risk (7-9).

The current aim of triage for patients with chest discomfort in the ED is to assign them to one of three groups: group 1

(high risk) – immediate admission and appropriate treatment, primarily selected by ST-segment shifts, clinical history and abnormal troponin levels; group 2 (intermediate risk) – further observation in the ED or, preferably, in a chest pain unit, as well as further testing, as appropriate, such as exercise or pharmacological stress testing before discharge or admission; and group 3 (low risk) – early discharge for outpatient investigation, if appropriate.

The selection of patients in groups 2 and 3 remains problematic. In the current issue of the *Journal*, McDonald et al (pages 287-292) present a new clinical risk score (possibly called the 'Edmonton score' to compensate the city for having the Stanley Cup blown away by a 'hurricane') using simple clinical details and a single troponin level to predict who may be safely discharged from the ED, and who should be further observed and tested. This score was derived from a large, prospectively collected database of patients presenting to a tertiary care hospital with chest discomfort and has yet to be tested in a prospective clinical trial. While not yet validated, it may be a useful addition to our clinical assessment of such patients. Such simple decision aids can help streamline care and investigation of chest discomfort patients in our increasingly busy EDs, as well as cut costs by decreasing the increasingly expensive stays in hospital (10). This new score depends heavily on the initial ECG, with male sex, prior congestive heart failure, three or more cardiac risk factors and prior acetylsalicylic acid use, in combination, being the most predictive of events at 30 days. A single troponin I measurement, presumably drawn on admission to the ED, is then used to help further identify patients in the very low risk subgroup who could presumably be discharged home.

Importantly, those with elevated risk scores in the paper by McDonald et al had significant 30-day event rates despite a negative initial troponin level, indicating the value of this score without having to wait for the troponin assay. The event rate in this group at three days was only 2.7%, while that in the total group discharged home from the ED was 7.2%. This suggests a significant clinical benefit in applying the new risk score to the triage of patients with chest discomfort with and without ST-segment shifts.

We should not be surprised that patients with ST-segment shifts had higher clinical event rates. Almost all risk assessments acknowledge that ECG abnormalities, especially ST-segment shifts, identify a group of patients at high risk (11). Indeed, recognition of ST-segment shifts and abnormal troponin levels, which, in combination, identify a high-risk group, would be accepted as sufficient to dictate admission with an ACS (12). It is the low-risk subgroup of patients

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without these abnormalities that is most troubling. Indeed, the frequency of clinical events in this group has been reported to be a significant 4.8% at six months and 6.7% at one year (9,13). The clinical score presented by McDonald et al in the current issue of the *Journal* appears to represent a valuable step in assessing this low-risk subgroup more accurately.

However, as an 'old clinician', I find some aspects of this new score troubling. The history of a patient's chest discomfort appears to have been ignored in developing this risk score. Other studies have demonstrated that the type of pain, its location and the associated symptoms are highly predictive (14), and that recurrences of such pain over the hours or days preceding the presentation are also important predictors. Clearly, even in our era of technological advances, a simple history is still of value. In addition, only the initial troponin level in this paper was considered, apparently without regard for the time interval between symptom onset and presentation to the ED. Consideration of the release kinetics of troponin after cellular injury should allow us to make better use of these measures, and judiciously repeat the test at a time when elevations may be expected to occur.

The assessment of patients without ST-segment shifts and with normal troponin levels was recently addressed in a paper by Sanchis et al (9). In this risk assessment study, clinical evaluation included a previously validated semiquantitative chest pain score composed by Geleijnse et al (14). Both the chest pain score and age were closely associated with the primary end point. The five clinical variables (all obtained by a simple clinical history) with the most prognostic value included a typical presentation of chest pain, two or more episodes of pain within 24 h, age older than 67 years, insulin-dependent diabetes mellitus and a prior percutaneous coronary intervention. A chest pain score of more than 11 (typical pain) outperformed all

other historical information except diabetes and cardiac surgery as predictors during multivariate analysis (9), confirming the overwhelming value of a taking good history in such patients. The authors' proposed clinical score for low-risk chest pain patients, defined as those without ST-segment shifts or troponin elevation, was more predictive of clinical events at one year than that of the commonly used Thrombolysis In Myocardial Infarction (TIMI) risk score. However, it must be acknowledged that the TIMI risk score was designed to facilitate risk stratification among patients with non-ST-segment elevation ACSs (15). It was not designed to aid in the diagnosis of ACSs, nor was it designed to aid in risk stratification of low-risk chest pain patients.

One of the 'truisms' of medical teaching is that there is no substitute for clinical judgment. Sadly, when it comes to assessing patients with chest discomfort in the ED, clinical judgment has been found wanting. Experienced clinicians still send 2% to 4% of acute MI patients home (16,17), with a resultant worse prognosis, but they admit too many patients 'to rule out MI' (10). On the other hand, several clinical risk scores to assess chest discomfort have been developed that have been shown to outperform clinical judgment, especially among the less experienced physicians. This does not mean that such scores can or should replace judgment. The most successful physicians will apply their experience-based clinical judgment to the information derived from scores such as those presented by McDonald et al in the current issue of the *Journal* or by Sanchis et al (11) among patients selected for discharge for early testing such as exercise perfusion imaging or admission for more aggressive care and treatment. In larger centres, such triage appears to be best carried out in a chest pain unit, but there is little reason why such stratification could not be carried out effectively from within smaller EDs.

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