Improving triage of patients with chest pain

Formal risk-based protocols and clinical audits of process indicators and outcomes are needed

"MISSED" MYOCARDIAL INFARCTION occurs when a patient with an unrecognised acute coronary syndrome is discharged from hospital prematurely. The correct diagnosis becomes apparent only when the patient has an infarct or cardiac arrest, or is later found to have biochemical evidence of myocardial injury. There has been a paradigm shift in management of patients with chest pain over the past decade, with the focus moving from establishing a diagnosis towards ensuring the safety of the management strategy. This change was heralded by the publication of Australian guidelines in 1996 that recommended:

- Initial risk stratification of patients using clinical variables;
- Admission of intermediate- and high-risk patients for 48 hours of clinical observation to identify those with recurrent ischaemia at rest or evidence of myocardial damage (raised levels of cardiac biomarkers or electrocardiogram [ECG] changes); and
- If these features are absent, stress testing to exclude exercise-induced ischaemia in all remaining patients before discharge.[1]

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Studies in the United States showed that the period of observation can be shortened to eight hours without affecting patient outcomes.[2,3] Management guidelines were updated accordingly.[4]

Missed myocardial infarction usually results from a breakdown in the system of care — the patient's risk has been underestimated or formal protocols have not been fully implemented.

Two studies in this issue of the Journal provide excellent examples of hospital strategies to improve the safety of chest pain triage. Aroney and colleagues (*page 370*) demonstrate that implementation of a protocol adhering to current Australian guidelines[4] minimises missed myocardial infarction.[5] They provide a benchmark for other hospitals to compare their practice. Boufous and colleagues (*page 375*) show that local implementation strategies can reduce medical error which contributes to missed myocardial infarction.[6]

A new "gold standard" for care. Aroney et al describe an "accelerated chest pain assessment protocol" that minimised hospital stay without jeopardising patient safety.[5] After identifying intermediate-risk patients, they implemented a rapid, two-step process to ultimately identify those who were low risk and suitable for early discharge. They shortened the period of observation to a minimum of six hours. The absence of a single infarct in the 409 patients classified as low risk is an excellent outcome, clearly confirming the safety of the protocol. Of interest, 11% of the study population had diabetes but were safely triaged by the protocol. Thus, the recent recommendation to classify all patients with diabetes as high risk may not be necessary. Validation of new markers of increased risk, such as C-reactive protein, may allow risk-stratification algorithms to be further refined.[7,8]

Aroney et al achieved their outcomes in a large teaching hospital where coronary care nurses and "on-call" cardiology registrars were used to implement weekend stress testing, the final step in risk stratification before discharge. As many Australian hospitals have fewer resources, it is worth identifying non-essential elements of the protocol. The study data allow limited assessment of the incremental value of each step in the protocol, excluding the 78 patients who were unable to perform an exercise test. Most of the remaining 142 at-risk patients were identified by clinical, ECG or cardiac biomarker findings. Continuous ST-segment monitoring detected less than 2% of at-risk patients. As this monitoring is expensive, its use is difficult to justify in smaller hospitals. On the other hand, 42 at-risk patients (30%) were identified by an exercise ECG. Thus, this test should not be omitted. Coronary angiography was recommended in high-risk patients, but was performed in only 41%, as many were frail or had significant comorbidities. It is interesting to speculate whether outcomes in this group could have been improved by attention to optimal medical therapy and routine stress imaging.

Are patients selected appropriately? Aroney et al do not report the numbers and outcomes of patients who were classified as low risk at initial clinical assessment and who were therefore not included in the study. Some at-risk patients may have been misclassified and discharged prematurely, predisposing them to missed myocardial infarction. Boufous et al audited this phenomenon.[6] Their method was imperfect, as the reviewing cardiologist had to rely on the original clinical records. Despite this reservation, it is reassuring that formal adoption and use of a risk-stratification algorithm by clinical staff halved the rate of inappropriate discharge from 20% to 10%. Nevertheless, some potentially at-risk patients were discharged against current guidelines. The study was too small to detect an impact on their outcomes, and, to my knowledge, there are no published data on outcome in this group.

However, the value of such a study is illustrated by an eight-month audit of emergency chest pain triage performed at my institution five years ago. Using a risk-stratification algorithm, we identified 136 intermediate-risk patients who were discharged contrary to guidelines. In most cases, patients were observed for at least eight hours, and serial biomarkers were measured. The guideline violation was primarily a failure to perform exercise stress testing, either because it was not available or because there was no in-patient bed to hold the patient until the test could be performed. Outcome was determined in all patients at one month. One death (documented ventricular fibrillation after

recurrent chest pain) and five myocardial infarctions occurred during this period: three of these events, including the death, occurred within 24 hours of discharge. While the outcome for this group of patients was not statistically different from the outcome in 116 patients managed appropriately and discharged within 24 hours (one missed myocardial infarction), the clinical significance of the data persuaded our hospital managers to fund exercise stress testing on weekends. Coupled with an education program and a protocol similar to that described by Aroney et al, we subsequently reduced our underadmission rate substantially.

How can hospitals improve triage of chest pain? It is unlikely that there will ever be high-level evidence to guide chest pain triage. As outlined above, poor outcomes such as missed myocardial infarction arise through medical error or inadequate resources, and the changes required to conduct a randomised trial would reduce the likelihood of the former and, by ethical necessity, ensure the latter. In the absence of high level evidence, hospitals should adopt methods to improve clinical practice,[9,10] such as strategies similar to those described by Aroney and Boufous. Risk stratification and standardised protocols can reduce medical error, as shown by Boufous et al.[6] To optimise bed use, all hospitals should adopt accelerated chest pain assessment protocols similar to that described by Aroney et al.[5] Lack of stress testing, particularly at weekends, is the major impediment to their widespread adoption. To inform local resource allocation, hospitals should audit indicators of process, such as appropriate risk stratification and underadmission of at-risk patients. They should also measure patient outcomes, and, if these outcomes do not match those of Aroney et al, then hospitals should revise their current management strategies.

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Asleep at the wheel: who's at risk?

Careful assessment of car accident risk in patients with sleep disorders should guide advice

ALCOHOL AND EXCESSIVE SPEED, often combined with inexperience and youthfulness, are the most widely recognised causes of motor vehicle accidents (MVAs). There is, however, increasing recognition that fall-asleep MVAs contribute significantly to road accident statistics.[1-5] The typical fall-asleep accident involves a sole driver driving at night or in the early afternoon "siesta" period at relatively high speed.[1] As with other causes of MVAs, fall-asleep accidents are more common in men under 30 years.[1,3,5]

In this issue (*page 396*), Desai and colleagues[6] describe seven cases of fall-asleep fatal MVAs, and highlight the inconsistent way in which the New South Wales legal system dealt with these cases. They also draw attention to the role of sleepiness and sleep disorders in these cases, five of which involved under-treated or unrecognised obstructive sleep apnoea.

These case studies are, by any measure, tragic, involving as they do serious injury, loss of life and, in several instances, imprisonment of the driver. They raise the question as to what role the medical profession might have in the prevention of such accidents.

Obstructive sleep apnoea is the most common clinical sleep disorder leading to daytime sleepiness. About 26% and 10% of the Australian adult male population have $\geq$5 and $\geq$10 sleep apnoeas or hypopnoeas per hour, respectively.[7] However, it is important to maintain perspective when thinking about this issue. First, while obstructive sleep apnoea is very common, most people with sleep apnoea will never have an accident due to sleepiness or be at significant risk for an accident.[8] The relative risk for MVAs among all people with obstructive sleep apnoea is about 2–7 compared with the general population. This seems high, but is similar to the increased risk associated with driving at night,[1] or for young drivers compared with older drivers. Second, sleep restriction (lack of sleep) is at least as common and is possibly of greater concern with respect to fall-asleep MVAs.[5] The drivers with sleep apnoea described by Desai and colleagues all had mild-to-moderate obstructive sleep apnoea, which normally would not be associated with a high risk of an MVA,[9] but, as acknowledged by the authors, the commercial drivers in particular were probably also sleep-deprived. In one case, prior sleep deprivation appeared to be the sole cause of the fall-asleep MVA.

Nevertheless, there are patients with obstructive sleep apnoea who constitute a real and immediate risk to other road users. How does a medical practitioner identify and