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PEER REVIEWED FEATURE
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Acute assessment of possible cardiac chest pain

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Key points

- **Determination of a patient's risk of an acute coronary syndrome (ACS) should not be based on symptoms and signs alone.**
- **The use of formal risk stratification is encouraged to determine a patient's probability of having an ACS.**
- **Highly sensitive troponin assays allow more rapid serial measurement of cardiac troponin for the identification of myocardial necrosis.**
- **Accelerated diagnostic protocols (ADPs) are now being used to rapidly identify low risk patients in the emergency setting for early discharge and outpatient management.**

Many changes have occurred recently in the assessment of patients presenting with possible acute coronary syndromes. The introduction of more sensitive cardiac troponin assays and the development of rapid assessment strategies is redefining the care of this group of patients.

Patients with symptoms such as chest heaviness, pain or pressure, with or without accompanying nausea, dizziness and shortness of breath, frequently present to general practitioners and emergency physicians. The most common serious condition associated with such presentations is acute coronary syndrome (ACS; encompassing acute myocardial infarction [AMI; i.e. ST-segment elevation myocardial infarction – STEMI – and non-ST-segment elevation myocardial infarction – NSTEMI] and unstable angina pectoris).

The symptoms of heart disease overlap with many other conditions, including gastro-oesophageal reflux and musculoskeletal disorders as well as other more serious conditions such as pulmonary embolism and aortic dissection (which are significantly less common than ACS). The focus of this article, however, is patients in whom there is a clinical concern of an underlying acute cardiac condition.

The burden of heart disease is a significant and increasing concern within Australia, with an estimated 90,000 patients admitted to hospital in 2009 for ACS.[1] Public campaigns about the signs and symptoms of heart disease have increased awareness of ACS, and the use of evidence-based treatments have significantly improved patient outcomes. However, guidelines for the assessment of patients with possible ACS, including those of the National Heart Foundation of Australia and the Cardiac

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1. SUSPECTED ACS: COMMON TOOLS FOR RISK STRATIFICATION[13,14,17]

The TIMI score

- Age 65 years and over
- Aspirin use in the past seven days
- At least two angina episodes within the past 24 hours
- ST changes of at least 0.5 mm (0.05 mV) on admission ECG
- Elevated serum cardiac biomarkers (troponin and/or creatine kinase-MB)
- Known CAD (coronary stenosis 50% or greater)
- At least three risk factors for CAD (e.g. hypertension, current smoker, hypercholesterolaemia, diabetes mellitus, family history of premature CAD)

The GRACE score

- Age
- Heart rate
- Systolic blood pressure
- Creatinine level
- Killip class
- Cardiac arrest at admission
- Elevated cardiac markers
- ST-segment deviation

The HEART score

- History
- ECG
- Age
- Number of risk factors
- Troponin level

ABBREVIATIONS: ACS = acute coronary syndrome; CAD = coronary artery disease; ECG = electrocardiogram.

Society of Australia and New Zealand (the NHF/CSANZ guidelines), have remained largely unchanged.[2-4] Research into the improved use of cardiac biomarkers and the application of rapid assessment processes, also known as accelerated diagnostic protocols (ADPs), are now challenging the traditional process of assessment and being incorporated into clinical care.

INITIAL ASSESSMENT

Clinical features

A detailed clinical history, including identifying existing cardiac risk factors, remains the cornerstone of assessment in patients suspected of having an ACS. This allows the identification of possible alternative diagnoses and, importantly, defines the likelihood, or pre-test probability, of the patient having an ACS.

Symptoms and signs are often clustered into typical and atypical groupings for ACS. 'Typical' symptoms include retrosternal pressure or heaviness radiating to the left arm or neck, and 'atypical' findings may include sharp and reproducible chest wall tenderness.[5] Unfortunately, the presence or absence of atypical features lacks sufficient ability to discriminate between patients with and without AMI.[6,7]

Although the recognition of cardiac risk factors is important, an absence of these also does not exclude ACS in an individual patient.[8]

Specific examination findings are often absent in patients with ACS but some findings should alert clinicians to an alternative underlying condition (e.g. fever and crepitation with pneumonia). The poor accuracy of clinical assessment alone, particularly in the exclusion of ACS, contributes to the diagnostic challenge of these patients.[9]

ECG

The key investigation on initial assessment of patients with possible cardiac chest pain is the ECG. The finding of ST-segment elevation should precipitate both the patient's urgent referral via ambulance to the nearest hospital for emergency reperfusion therapy and the immediate administration in the primary care setting of aspirin, unless contraindicated.[4] Many other ECG findings may be seen in patients with ACS, including ST-segment depression and T-wave changes. A normal ECG does not exclude ACS.[10]

Risk stratification

International guidelines for the management of ACS, including the NHF/CSANZ guidelines, recommend a process of risk stratification (using a formal tool) for the management of patients with suspected ACS without ST-segment elevation on ECG.[4,11,12] The NHF/CSANZ guidelines recommend that patients are categorised according to high, intermediate and low risk features.[4]

Various risk stratification tools are used in clinical practice: two of the most commonly used are the Thrombolysis in Myocardial Infarction (TIMI) score and the Global Registry of Acute Cardiac Events (GRACE) score (Box 1).[13,14] Although these scores were not derived in undifferentiated patient groups, their usefulness in unselected emergency patients has been described.[15,16]

More recently, the HEART score, which is based on features in the History, ECG, Age, Risk factors (number of) and Troponin values, has been shown to correlate with the risk of an ACS in patients who have presented to the emergency department with chest pain (Box 1).[17] However, even the lowest risk grouping (HEART score of 0 to 3 points) correlated with a 30-day major adverse coronary event rate of 1.7 to 2.5%,[17,18] a rate that is unacceptable to most emergency department physicians.[19]

Comparison of the performances of the TIMI, GRACE and HEART scores in an undifferentiated Australian emergency department population shows significant differences to that of the NHF/CSANZ risk categories.[17,20] Studies are ongoing to determine the optimum tool.

Cardiac biomarkers

The measurement of biomarkers, specifically cardiac troponin, is required in patients with suspected ACS to assess whether there is evidence of myocardial necrosis.[4,11] In the current universal definition of AMI, one of the criteria for the diagnosis requires the detection of a rising or falling pattern of change of cardiac biomarker, preferably cardiac troponin, with at least one of several other requirements.[21] Serial samples of cardiac troponin are therefore needed. A single sample is

TABLE. SUSPECTED ACS: THE ADAPT AND MODIFIED ADAPT TWO-HOUR ACCELERATED DIAGNOSTIC PROTOCOLS[24,26]

ADAPT	Modified ADAPT
Cardiac troponin I level at 0 and 2 hours below the 99th percentile using a sensitive troponin assay	Cardiac troponin I level at 0 and 2 hours below the 99th percentile using a highly sensitive troponin assay
No new ischaemic changes on the initial ECG	No new ischaemic changes on the initial ECG
TIMI score = 0	TIMI score = 0 or 1

ABBREVIATIONS: ACS = acute coronary syndrome; CAD = coronary artery disease; ECG = electrocardiogram.

rarely sufficient, and with current evidence scant, the only exception is probably in the context where the sample is taken 12 hours or more after all symptoms have resolved, a situation that is not often found in general practice and is rare in the emergency department.[22] There is no evidence to support the exclusion of AMI as a diagnosis based on a single troponin sample in all-comers, even when using highly sensitive troponin assays.[23] Patients are usually referred to their local hospital for the obtaining of serial samples.

The timing of serial samples depends on the type of troponin assay and the assessment strategy being used. The highly sensitive troponin assays used in many laboratories are more precise at low concentrations of circulating troponin and are able to report reliable values within the normal reference range in a large percentage of patients without cardiovascular disease. Although the traditional recommendation for serial testing using sensitive assays is taking samples six to eight hours apart, the use of highly sensitive assays can shorten this time to three hours.[12] The current NHF/CSANZ guidelines recommend that the second sample must be taken at least six hours after symptom onset.[2]

FURTHER INVESTIGATIONS

Patients at high risk of an ACS as determined by ECG, risk stratification and serial troponin testing should be admitted to hospital.[4] The vast majority of patients with suspected ACS will not meet this criteria, but many will require objective testing, such as with exercise stress testing, nuclear myocardial perfusion scanning and/or CT coronary angiography, to exclude underlying coronary artery disease and unstable angina pectoris.[4,20] The choice of investigation and the admission of such intermediate risk patients will vary according to local practices.

The management of this cohort of patients is becoming more challenging for emergency departments because of the additional focus of the National Emergency Access Target (NEAT), which requires the majority of patients in Australia to be either treated and discharged or admitted to an inpatient ward within four hours of their presentation to an emergency department. The current lengthy process of assessment is incompatible with NEAT requirements, and many patients now require admission to comply with guidelines and maintain appropriate periods of assessment in the emergency department.

Rapid assessment processes – accelerated diagnostic protocols

Recently, strategies to identify true low-risk patients who do not require such a lengthy assessment process for ACS and hospital admission have been investigated. A two-hour accelerated diagnostic protocol (ADP) protocol has been studied in Australian and New Zealand emergency department patients – the ADAPT (Two-Hour Accelerated Diagnostic Protocol to Assess Patients With Chest Pain Symptoms Using Contemporary Troponins as the Only Biomarker) trial. This trial defines a low-risk patient deemed appropriate for outpatient management as one who has a TIMI score of 0, no ischaemic ECG changes at zero and two hours, and normal serial samples of troponin tested with sensitive troponin assays at zero and two hours after presentation (Table).[24] In the emergency department setting, 20% of patients fulfil this criterion, with 0.25% having a major adverse cardiac event within 30 days.[24] Such a strategy has been successfully piloted in Queensland, and a wide roll out of the ADP is planned.[25]

More recently, the ADAPT protocol has been modified to include troponin values determined with highly sensitive assays (Table).[26] With the improved precision of these assays at low values, patients with TIMI scores of 0 or 1 are included in the low-risk category. The ability to identify safely those patients truly at low risk is maintained using this modified protocol, and it supports the discharge of double the proportion (40%) of low-risk patients compared with ADAPT.[26] The modified ADAPT protocol has been externally validated in a large Swiss cohort.[26]

It is likely that the use of rapid assessment strategies will reduce the burden on busy emergency departments caused by patients with suspected ACS, and thereby improve the flow within such departments and hospitals.

THE RURAL SETTING

The assessment of patients with possible cardiac chest pain in the rural setting is

2. PATIENT EDUCATION: WARNING SIGNS OF A HEART ATTACK

Remind patients that the warning symptoms of a possible heart attack are varied:

- Chest discomfort or pain – may be described as a tightness, heaviness or pressure
- Discomfort in arms, shoulders, neck, jaw or back
- Shortness of breath
- Nausea
- Sweating
- Dizziness or light headedness

similar to that in metropolitan areas. Factors that may alter the process include that the point-of-care troponin assays generally used in rural areas are sensitive (rather than highly sensitive). Therefore, rapid assessment strategies that have been shown to be safe using sensitive assays should be used in patient care. Many of the ADPs have not been tested with point-of-care assay results at this stage.

Determining the urgency for follow-up testing in patients in whom serial troponin testing and ECG results are normal can be challenging. It is hoped that with strategies that allow the identification of patients at low risk of a major adverse cardiac event within 30 days, the urgent transfer of some patients for testing beyond serial troponin level measurement could be minimised.

ONGOING MANAGEMENT

Patients require ongoing management after the acute event, with the particular focus in the GP setting of active risk factor modification and rehabilitation.[9] Coronary artery disease is an evolving condition, with prevention of progression of underlying disease a key initiative in the general practice setting. Continuing hypertension management, smoking cessation, glycaemic control, and lipid and weight management are indicated, where required.

Patient education about the variety of warning symptoms of possible heart attacks is also required (Box 2), with emphasis on reducing delays in seeking medical attention to optimise outcomes in future events. Resources from the National Heart Foundation of Australia are accessible by patients and may assist with ongoing education (www.heartfoundation.org.au/SiteCollectionDocuments/Warning-Signs-CHD-patient-fact-sheet.pdf).

CONCLUSION

Many changes have occurred recently in the assessment of patients with possible ACS, the most common serious condition associated with chest pain. Although some of these changes are significant, the effect of these developments has yet to be shown to alter the care in the general practice setting of patients with suspected ACS. It is hoped in the future that improved strategies will allow patients at low risk of a major cardiac event to be managed solely by general practitioners. MT

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A list of references is included in the website version (www.medicinetoday.com.au) and the iPad app version of this article.

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