

Original Article

Multiple Cardiac Biomarkers Used in Clinical Guideline for Elderly Patients with Acute Coronary Syndrome

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SUMMARY

Background: Bedside cardiac biomarker (CB) is a crucial diagnostic tool used in the emergency department (ED) for older patients with chest pain. We compared various bedside CB panels test results and suggested a bedside-testing-based clinical guideline with improved accuracy of diagnosis and more time efficiency for this group of patients.

Methods: 146 elderly patients (age ≥ 65) received three different bedside CB panel tests. One test had multiple cardiac biomarkers (MCB) including myoglobin, Troponin-I, creatinine kinase myocardial band isoenzyme (CK-MB), B-natriuretic peptide (BNP); another one had two biomarkers Troponin-I and CK-MB; the last one tested with Troponin-I only. The final clinical diagnosis of each patient had confirmed in 45 days afterward. We evaluated the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), positive likelihood ratio (LR+), negative likelihood ratio (LR-), and receiver operating characteristic (ROC) curve.

Results: The sensitivity of the bedside MCB system was 80%, and the NPV was 87%, which proved to be of more benefit than the other two CB panel tests (0.14, 0.23 vs. 0.79, 0.79). In contrast, the CB test based on Troponin-I alone had the best LR+, as opposed to the CB test of Troponin-I with CK-MB, and the MCB test (15.86 vs. 4.23, 1.43).

Conclusion: Bedside MCB test system with high levels of sensitivity and NPV can be a preferred point of care test used in our suggested guideline to help ER physicians rapidly differentiate elderly patients with ACS from ones with non-cardiac chest pain.

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1. Introduction

Heart disease is one of the leading causes of death for people over 65 years of age group in the US, and it ranked second in a 2001 report.¹ Heart disease often appears unexpectedly. It can result in death without early diagnosis and treatment. The mortality rate for heart disease is higher in elderly patients compared with younger ones.^{2,3} Elderly patients with myocardial infarctions (MI) are frequently treated too late.^{4,5} Research shows that 29.4% of patients

aged 65 and over with MI do not receive treatment until 6 h after the emergence of symptoms.⁶

The diagnosis of acute myocardial infarction (AMI) relies primarily on clinical manifestations, electrocardiograms (ECG), and cardiac markers, among which, two are sufficient to determine AMI.⁷ Cardiac markers often play key roles in making a definite diagnosis in chest pain patients group with equivocal ECG findings. Troponin-I (TnI), currently the primary determinant on which diagnoses are based, generally does not increase until 6 h after the emergence of symptoms. Nonetheless, research shows that the use of multiple cardiac biomarker tests can improve the accuracy in diagnosing AMI.⁷

This study employs multiple cardiac biomarker (MCB) tests in conjunction with a clinical decision making pathway (Fig. 1) for

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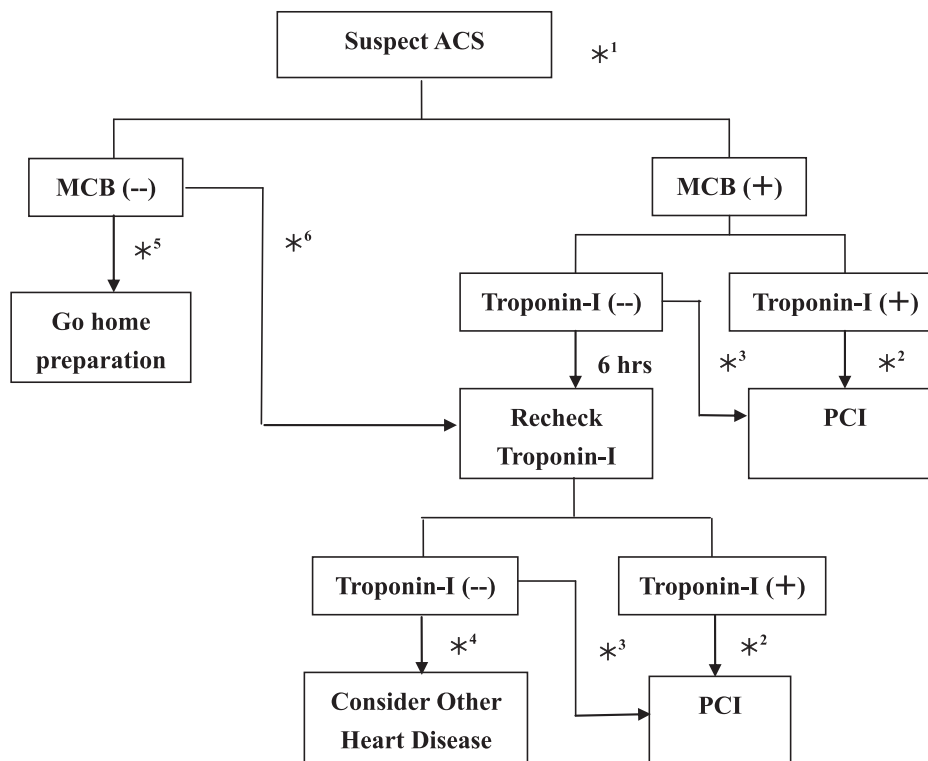


Fig. 1. The clinical decision making pathway for elderly patients with chest pain. *1 The elderly patients who are highly suspected with cardiovascular ischemic origin chest pain, but have no enough evidence from repeat ECG with obvious ST elevation or new LBBB changes to support the diagnosis of acute coronary syndrome. *2 May perform repeat ECG and evaluate the ECG changes. Whether the results of electrocardiogram findings are positive or not, it should immediately arrange a cardiac catheterization PCI to assure the diagnosis of myocardial infarction. *3 The elderly patient presents a new complaint of typical chest pain with a new ST elevation finding on repeat ECG during observation. Cardiac catheterization PCI should be performed immediately. *4 If repeat ECG is still normal, other cardiovascular emergency conditions such as heart failure or aorta dissection must be considered. *5 No new onset of chest pain or abnormality on repeat ECG, the patient could be discharged and have an outpatient follow-up, no further observation required. *6 The elderly patient presents a new complaint of typical chest pain with a new ST elevation finding on repeat ECG during observation, recheck Troponin-I immediately.

patients aged 65 and over with chest pain, who were clinically suspected of acute coronary syndrome (ACS), to determine the possibility of providing efficient and accurate diagnoses.

2. Methodology

This study was approved by the institutional review boards of Mackay Memorial Hospital, file NO. 08CT1109. Informed consent from human subjects where applicable.

2.1. Patient enrollment

Between March and November 2009, patients who presented to ED with suspected ACS in Taipei Mackay Memorial Hospital were recruited for this study. All enrolled patients were at least 65 years old and met one of the following criteria: 1) clinical symptoms of chest pain or suspected symptoms of ACS, 2) atypical symptom of chest pain requiring diagnostic ECG and cardiac markers to exclude the possibility of ACS. Subjects with >1 mm ST-segment elevation in two contiguous leads or new or presumed new left bundle branch block (LBBB) were excluded, since these clearly show the onset of AMI, and do not require diagnosis by multiple cardiac biomarkers (MCB) test systems. Other exclusion criteria include laboratory creatinine level greater than 2.5 mg/dL to avoid false positive test results; Non-Taiwan residents whose follow-ups were not available; patients were transferred in from another hospital and not willing to participate or informed consents not obtainable. Inclusion and exclusion criteria used to select the study subjects are summarized in Table 1.

Table 1
Study inclusion and exclusion criteria.

Inclusion criteria
Age of 65 years old or greater with at least one of the following conditions
- Clinical symptom of chest pain or suspected symptoms of ACS
- Atypical symptom of chest pain requiring diagnostic ECG and cardiac markers to exclude the possibility of ACS
Exclusion criteria
Age <65 years old
Renal insufficiency (Creatinine > 2.5 mg/dL)
Non-Taiwan residents and contact information not available
Over 2 h since visiting emergency department
Transfer in patients (from a hospital or another ED)
Informed consent not obtainable
Refusal of participation
Non-cardiac causes of chest pain
Initial ECG shown > 1 mm ST elevation in 2 contiguous leads or new or presumed new LBBB

Researchers followed each enrolled patient physical condition and documented any medical issues by telephone interviews and medical charts review within 45 days after the test. A period of 45 days was selected in consideration of time-consuming processes of telephone follow-up and medical charts review. All participants received percutaneous coronary intervention (PCI) during admission. Cardiovascular event or acute coronary syndrome was confirmed with one of the following conditions: cardiac arrest, cardiogenic shock, ST-segment elevation myocardial infarction (STEMI), non-ST-segment elevation myocardial infarction (NSTEMI), ventricular arrhythmia, high degree atrial-ventricular block, unstable angina, and heart failure.

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