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Original Article

Predicting outcomes in acute coronary syndrome using biochemical markers

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ABSTRACT

Objectives: To assess risk prediction in patients with acute coronary syndrome (ACS) during the hospital stay, at 6 weeks and at 6 months period using high sensitivity C-reactive protein (hs-CRP), serum creatinine, cardiac troponin I, creatine kinase total, and MB levels.
Methods: It was a prospective observational study. The primary outcome was taken as all-cause mortality. Patients with ACS were enrolled and followed up at 6 weeks and 6 months duration from the index event. Mortality and cause of death were recorded. The hs-CRP was estimated on admission, at 6 weeks, and at 6 months. The estimated glomerular filtration rate (eGFR) was calculated using the abbreviated modification of diet in renal disease (MDRD) formula at admission, at 6 weeks, and 6 months.
Results: There were a total of 108 cases of ACS in the duration of 6 months who completed the follow-up. The hs-CRP level of >5 mg/dl was highly significant for predicting mortality during hospital stay and at 6 weeks ($p < 0.001$). There was 11% of in-hospital mortality ($p < 0.001$). At 6 months, the overall mortality was 28% ($p < 0.001$). There was a statistical significance with low eGFR (median eGFR 45 ml/min/1.73 m^2) levels during the admission.
Conclusion: hs-CRP levels above 5 mg/dl and the eGFR levels ≤30 ml/min/1.73 m^2 were significant in predicting mortality of the patients with ACS. This may provide simple assessment tools for predicting outcome in ACS in resource-poor settings if validated further.

1. Introduction

Cardiovascular disease (CVD) is the prevailing non-communicable cause of death and disability in the Indian subcontinent, and will become the prevailing overall cause of mortality among the inhabitants of South Asia in the next 20 years. The current epidemic and imminent growth are due to the huge burden of CVD risk factors, largely driven by urbanization.[1,2] Although we do not have any national data on ischemic heart

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disease (IHD), it was found that the prevalence of CVD is increasing and there is a fivefold increase in the incidence of coronary artery disease (CAD).[3]

The significance of the contribution of laboratory medicine to clinical cardiology has grown in importance over the years. This is witnessed by the recent incorporation of biomarkers into new international guidelines and in the redefinition of myocardial infarction (MI). There are mainly two classes of indicators: markers of early injury/ischemia and markers of inflammation and coronary plaque instability and disruption.[4]

There are various biomarkers associated with acute coronary syndrome (ACS). The clinical application of cardiac biomarkers in ACS is no longer limited to establishing or refuting the diagnosis of myocardial necrosis. Cardiac biomarkers provide a convenient and noninvasive means to gain insights into the underlying causes and consequences of ACS that mediate the risk of recurrent events and may be targets for specific treatment.[4] Biochemical markers play a major role for risk assessment in patients with an ongoing non-ST segment elevation ACS. Although the cardiac troponin in particular is generally recognized as an important risk indicator, other markers of left ventricular performance (i.e. N-terminal pro-brain natriuretic peptide), inflammation (i.e. C-reactive protein), and renal function (i.e. estimated glomerular filtration rate (eGFR)] are equally important in providing strong prognostic information.[5,6]

With the availability of highly specific and sensitive methods for evaluating myocardial tissue damage, such as the immunoassays for MB isoenzyme of creatine kinase (CK MB), myoglobin, and especially, cardiac specific troponin T and I (cTnT and cTnI) and their introduction in clinical practice, the definition of acute myocardial infarction (AMI) has radically changed.[7]

The information gathered from this study would help us in various ways. Firstly, it will help us predict the outcomes of the patients with ACS using the commonly used biomarkers and thus the treatment of the patient can be guided. The demographic information provided by this study shows us that ACS is increasing in Nepal, especially in the young population. This study provides us a complete profile of patients with ACS.

2. Objective

The study was undertaken to assess risk prediction in patients with ACS during the hospital stay, at 6 weeks, and at 6 months period using high sensitivity C-reactive protein (hs-CRP), serum creatinine, cTnI, and CK MB fraction.

3. Materials and methods

3.1. Study design

The study was hospital-based prospective observational study, which was more practical in our setting and ethically acceptable.

3.2. Setting

This study was conducted in the Department of Internal Medicine at B.P. Koirala Institute of Health Sciences, Dharan, Nepal for a period of 1 year.

3.3. Primary outcome

All-cause mortality.

3.4. Inclusion criteria

All the patients meeting the diagnostic criteria of ACS, who were admitted under the Department of Internal Medicine at B. P. Koirala Institute of Health Sciences and who gave consent, were enrolled for this study.

3.5. Exclusion criteria

Alternate diagnosis of chest pain and/or refusal to give consent for the study.

For the purpose of the study, different components of ACS were defined as following:

(1) **ST elevation Myocardial Infarction (STEMI)**:
   (a) Characteristic rise and fall of cardiac biomarkers (presence of troponin I, and/or rise of CK NAC and CK MB)
   And
   (b) Central ischemic chest pain (described as retrosternal pressure, pain, discomfort, or heaviness radiating to neck, jaw, left arm, or shoulder precipitated by exertion more than 20 min)
   And/or
   (c) Typical ischemic ECG changes:
   - ST elevation in at least two contiguous leads, ≥0.2 mV in leads V1–V3 or ≥0.1 mV in all other leads.
   - Established MI (in the absence of confounders) is indicated by any Q wave in leads V1–V3 or by Q waves of ≥1 mm for ≥30 ms in two other contiguous leads.
   - Presumed new left bundle branch block.

(2) **Non-ST elevation myocardial infarction (NSTMI)**: Features as described for STEMI, but not meeting electrocardiographic ST-T criteria.

(3) **Unstable angina**:
   At least one of the following:
   (a) Chest discomfort occurring at rest or at minimal exertion and lasting for >10 min;
   (b) Is new onset and severe (within last 6 weeks);
   (c) Occurs with crescendo pattern.

3.6. Variables studied

Cardiac troponin I (cTnI), hs-CRP, eGFR using four variable modification of diet in renal disease (MDRD) equation, and serum CK MB levels in patients with ACS during index event, at 6 weeks, and 6 months.