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ORIGINAL ARTICLE

Predicting Coronary Heart Disease in Remote Settings: A Prospective, Cross-sectional Observational Study

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Background Coronary heart disease (CHD) places a major burden on the Australian health care system. Determining the likelihood of CHD in a patient presenting with chest pain can be particularly difficult in a remote setting where access to transportation and specialised investigations including myocardial stress studies and coronary angiography can be difficult and delayed. The objective is to develop a predictive model for determining the risk of CHD, including the value of high sensitivity C-reactive protein (hsCRP), in patients presenting with chest pain with a particular emphasis on resources and information likely to be available in a remote primary health care setting.

Methods A prospective, cross-sectional observational study of patients with no prior diagnosis of CHD presenting to a specialist chest pain assessment clinic at Cairns Hospital from November 2012 to May 2013.

Results Out of the 163 participants included in the study analyses, a total of 38 were classified as CHD likely (23.3% (95% CI 17.1-30.6)). Logistic regression modelling identified two factors that were independently associated with likely CHD, namely the presence of typical chest pain (OR 83.7 (95% CI 21.7-322.1)) and an abnormal baseline ECG (OR 12.8 (95% CI 1.9-86.0)).

Conclusion In this study, it was demonstrated that the presence of typical chest pain and an abnormal resting ECG, remain the cornerstone of predicting a subsequent diagnosis of CHD. This information is easily accessible in remote primary health care and should be utilised to expedite assessment in patients presenting with symptoms suggestive of CHD.

Keywords C-reactive protein • Inflammatory markers • Coronary artery disease • Diagnosis • Chest pain • Risk factors

Introduction

Coronary heart disease (CHD) places a major burden on the Australian health care system particularly for diagnosing and managing patients who present with symptoms that are suggestive of CHD. For the prompt diagnosis of CHD, the issue of remoteness is particularly important as access to diagnostic investigations can be challenging and often delayed.

When considering the risk of CHD, it is important to distinguish between people who are currently asymptomatic and

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those who have symptoms. A large number of cardiac risk calculators exist to predict the risk of a future cardiovascular event in asymptomatic individuals [1–7]. Whilst such calculators have utility in determining subsequent cardiovascular risk in asymptomatic people, they are not useful or validated for assessing the likelihood of CHD in a patient presenting with a history of suggestive symptoms such as chest pain.

Determining the probability of a subsequently confirmed diagnosis of CHD in a patient presenting with a history of chest pain or other symptoms is less well defined. Typically it involves an *ad hoc* combination of clinician-perceived probability, history (including chest pain type), examination findings, and relevant investigations. The utility of these factors and newer markers of cardiovascular risk, such as the inflammatory marker C-Reactive Protein (CRP), remains poorly understood. This is particularly the case for people living in rural and remote Australia including many Aboriginal and Torres Strait Islander people. In this setting, an improved and validated approach to assessing the risk of CHD in patients presenting with a history of chest pain or associated symptoms is required. This would provide a more rational approach to balancing patient, family and local clinician preferences with the availability of finite transport and distant diagnostic, specialist and management services.

In patients presenting with a history of chest pain or other suggestive symptoms of CHD, the objective of this study was therefore to:

i. Examine the usefulness of existing data available to primary and remote health care in predicting a subsequent diagnosis of CHD
ii. Determine whether the addition of high sensitivity CRP (hsCRP) improved this prediction
iii. Establish if such predictive algorithms were equally useful in Aboriginal and Torres Strait Islander people and non-Indigenous Australians.

Methods

Study design and setting

A prospective, cross-sectional observational study of patients referred to a northern Australian specialist cardiology chest pain clinic.

Eligibility criteria and selection of participants

Participants were a random sample of all men and women aged 18 years or older who were referred to the specialist cardiology chest pain clinic at the Cairns Hospital, Queensland, Australia from November 2012 to May 2013 and who did not have an existing diagnosis of CHD.

Variables measured

Variables assessed included potential predictive factors and outcome variables. Potential predictive factors related to demographics (age, gender, ethnicity), patient history (BMI, systolic and diastolic blood pressure, chest pain type, smoking and alcohol consumption, family history), existing medical diagnoses (including hypertension, diabetes mellitus, dyslipidaemia, chronic kidney disease, heart failure, cerebrovascular and peripheral vascular disease) and standardised baseline pathology (renal function, lipids (total cholesterol, HDL, LDL), percent glycosylated haemoglobin, full blood count including haemoglobin concentration, platelets, mean cell volume, red blood cell count and white cell count (including differential)) and a baseline resting ECG.

Chest pain type was based on the Diamond and Forrester classification with three domains assessed: retrosternal component; brought on by stress or exercise; and relieved promptly by rest or glyceryl trinitrate (GTN) [8]. Chest pain was defined as typical if all three criteria were met, atypical if two out of three criteria were met and, finally, non-anginal if one or no criteria was met. Smoking and alcohol consumption were classified as dichotomous variables, defined by whether the patient had never smoked/regularly drunk alcohol or was a past/current smoker or regular consumer of alcohol.

The primary outcome variable was a specialist cardiology assessment of the likelihood of CHD classified as likely or unlikely. Whilst an additional classification of 'indeterminate' was provided, this was not utilised in the classification of any patient.

Data measurement and bias

Demographic details were collected from patients at the time of enrolment and prior to chest pain clinic review. The consulting specialist cardiologists collected clinical and past history data using standard data definitions. Primary outcome data (CHD likelihood) were obtained from the cardiologists' final clinical summaries relating to participants' diagnosis and management plans. Laboratory results were obtained from the hospital electronic laboratory database and results of additional cardiac investigations, when performed, were retrieved from patient health records. Reporting bias was possible due to the fact that there were three consultant cardiologists consulting in the chest pain clinic and possible variability in interpreting and reporting additional cardiac investigations.

Sample size

Sample size estimations were based on the recommendations of Katz [9] and Peduzzi *et al.* [10] who recommended 20 observations for each potential predictive variable. In this case it was assumed, based on earlier studies of CHD prediction, that 5-10 predictive factors might be encountered requiring a sample size of 100-200 patients.

Ethics and statistical analysis

Ethics approval was obtained from the Human Research Ethics Committees of the Cairns and Hinterland Health Service District (HREC/12/QCH/26–775) and James Cook University (H4961). All participants provided written informed consent. Where necessary, language and intercultural interpreters were used for Aboriginal and Torres Strait Islander patients.

Descriptive univariate analyses were performed on independent variables. A bivariate correlation matrix was

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