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ORIGINAL ARTICLE

Prevalence of Asymptomatic Coronary Heart Disease in the Siblings of Young Myocardial Infarction Patients as Detected by Coronary Computer Tomography Angiography: A Pilot Study

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Background There is little data on the prevalence of coronary heart disease (CHD) in the young. The study aimed to estimate the prevalence of asymptomatic CHD in siblings of young patients with myocardial infarction (MI) using coronary computed tomography angiography (CCTA).

Methods Prospective observational data was collected on siblings of patients aged ≤55 years presenting with acute MI and having coronary stenosis ≥50% on invasive coronary angiography in at least one epicardial coronary artery. Inclusion criteria included ages 30–55 and 30–60 years for males and females respectively. Outcome of interest was obstructive CHD by coronary computer tomography angiography (CCTA), which was defined by either moderate (50–69% stenosis) and/or severe (≥70% stenosis).

Results Fifty participants were studied of whom 20 (40%) were male. Thirty (60%) were current or ex-smokers, 4 (8%) had diabetes, 8 (16%) had hypertension and 26 (52%) had dyslipidaemia. Obstructive CHD by CCTA was detected in 9 (18%, 95% CI 9%–31%) participants and 3 (6%, 95% CI 1%–17%) participants were found to have severe luminal stenosis. The median radiation dose was 3.9 (IQR 0.9) mSv.

Conclusions Approximately a fifth of siblings of young MI patients were found to have asymptomatic but obstructive CHD detected on CCTA of which one third was severe. This is a group in whom screening for CHD warrants further investigation.

Keywords Cardiovascular risk score • Coronary computer tomography angiography • Coronary heart disease • Risk factor • Screening • Young adult

Abbreviations: ACE, angiotensin converting enzyme; ARB, angiotensin II receptor blocker; BMI, body mass index; CABG, coronary artery bypass grafting; CCTA, coronary computer tomography angiography; CHD, coronary heart disease; CI, confidence interval; CVA, cerebrovascular accident; HDL, high-density lipoprotein; HU, Hounsfield unit; LDL, low-density lipoprotein; LMCA, left main coronary artery; MI, myocardial infarction; mSv, millisievert; NSTEMI, non ST-elevation myocardial infarction; OR, odds ratio; PCI, percutaneous coronary intervention; PVD, peripheral vascular disease; SE, stress echocardiography; STEMI, ST-elevation myocardial infarction

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Introduction

Despite improving trends, coronary heart disease (CHD) remains the leading cause of death in the world [1]. Often the initial presentation of patients with CHD is myocardial infarction (MI) with a sizeable proportion presenting catastrophically due to sudden cardiac death [2]. In addition, silent myocardial ischaemia has been demonstrated to be a strong predictor of future CHD related morbidity and mortality [3]. Implementation of an effective screening strategy, therefore, has the potential to reduce a substantial proportion of future CHD related events [4,5]. Current data does not support mass screening of the general population for occult CHD and, therefore, it is imperative to identify an appropriate cohort who will benefit greatest from a screening program [5]. The prevalence of CHD increases with age [6] but contemporary data appears to show a considerable proportion of the young are also affected [7,8]. A CHD screening strategy directed at the young may yield higher rewards due to the potential for increased life expectancy and the socioeconomic impact from the consequence of CHD in this subgroup. It is not feasible to screen all young individuals, hence an 'at risk' cohort needs to be identified [5]. Family history of premature CHD has been identified as one of the major risk factors for CHD [9–11]. This risk is not only restricted to parental history but also includes siblings with a history of CHD [12]. Hence family history and, in particular, sibling history of premature CHD could potentially be used to identify an 'at risk' cohort.

Coronary computer tomography angiography (CCTA) allows non-invasive detection of CHD with high sensitivity and specificity [13]. It has been used in the past to demonstrate asymptomatic CHD in a young cohort but with a relatively low yield that likely suggests under-estimation of the prevalence due to indiscriminate screening [14]. Exposure to radiation has been a concern with the use of CCTA. Due to advances in computer tomography technology, however, the radiation dose of CCTA has decreased significantly below 5 mSv and is approaching 1 mSv [15].

The Screening for Asymptomatic Coronary Heart disease in the Siblings of young Myocardial Infarction patients (SACHSMI, Australian New Zealand clinical trial registry number ACTRN12614000105640) study aims to demonstrate the feasibility of a screening program for CHD in a young 'at risk' group. The primary aims of this study are to estimate the prevalence of asymptomatic CHD in young siblings of young MI patients as detected by CCTA and to evaluate the reliability of cardiovascular risk scores for the prediction of CHD.

Methods

Participant Selection

Patients aged 55 years or younger presenting with acute MI and at least 50% stenosis demonstrated in at least one epicardial coronary artery on diagnostic coronary angiography to a tertiary community based hospital in Melbourne, Australia were prospectively identified. This group comprised the index MI cohort. Those less than 18 years of age were excluded. Patients presenting with spontaneous coronary artery dissection or stent thrombosis were excluded. The purpose of this was to ensure the cause of MI was coronary atherosclerosis.

These patients were then contacted to determine if they had siblings aged between 30 and 55 years, if male, and 30 and 60 years, if female. Subsequently, the siblings were invited to participate in the study following informed consent. The siblings comprised the participants for our study. Exclusion criteria included symptoms of CHD, known history of CHD, refusal to consent, intolerance to intravenous contrast, chronic renal impairment, atrial fibrillation, thyrotoxicosis, pregnancy, ventricular pacing, left bundle branch block, severe valvular heart disease and malignancy. The institutional human research ethics committee approved the study.

Screening Tools

All participants were invited to undergo a CCTA, which was performed with a low radiation dose (<5 mSv) algorithm in compliance with the Australian National Health and Medical Research Council guidelines [16]. All CCTAs were performed with the General Electric^{TM} 64 slice volume computed tomography (VCT) (General Electric (GE) Healthcare, Waukesha, WI, USA) scanner using low radiation dose scanning protocol with prospective gating step and shoot scanning mode with 100 kvp. Agatston coronary calcium score and CCTA reformatted images were obtained from the CCTA study for further analysis. Two Society of Cardiovascular Computerised Tomography level II equivalent (or higher) CCTA reporters read all studies. Coronary heart disease by CCTA was considered present if there was at least one epicardial coronary artery with stenosis. Severity of CHD by CCTA was defined as none (0% luminal stenosis), mild (<50% luminal stenosis), moderate (50–69% luminal stenosis) and severe (≥70% luminal stenosis) in at least one epicardial coronary artery. Obstructive CHD by CCTA was defined as the presence of either moderate or severe stenosis in at least one epicardial coronary artery.

On a separate occasion, all participants underwent stress echocardiography. A standard protocol for conducting stress echocardiography was followed [17]. Stress was induced either via graded treadmill exercise according to the Bruce protocol or with intravenous dobutamine to achieve target heart rate. A cardiologist subspecialising in echocardiography interpreted all stress echocardiography studies. A positive stress echocardiography was defined as the presence of a new or worsening regional wall motion abnormality in one or more segments.

In order to calculate cardiovascular risk scores, fasting blood samples were obtained and analysed for total cholesterol, high-density lipoprotein (HDL) cholesterol, calculated low-density lipoprotein (LDL) cholesterol and triglycerides. Framingham [18], HeartScore [19] and InterHeart [20] risk score calculations were conducted for all participants.

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