



Prognostic accuracy of Exercise ECG and CT Coronary Angiography to predict Major Adverse Cardiac Events (MACE) in patients with suspected Acute Coronary Syndrome (ACS): A systematic review

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Introduction

Acute coronary syndrome (ACS) typically occurs when a patient with coronary artery disease (CAD) develops an obstruction in their coronary arteries. Chest pain is responsible for 700,000 admissions to Emergency Departments (ED) per year in England and Wales (1). The differentiation of ACS from other non-cardiac causes of chest pain can present a challenge. Inappropriate discharge of high risk patients from the ED carries the risk of future cardiac events, whilst substantial costs can be incurred through admittance of low risk patients to cardiac wards. Therefore accurate risk stratification is important for patients presenting with suspected ACS.

Whilst exercise ECG and CT coronary angiography (CTCA) are both tools commonly used to assess patients with stable symptoms due to CAD, they are less commonly used in the risk stratification of patients presenting to the ED with suspected ACS.

Aim of the review

The review assessed the prognostic accuracy of Exercise ECG and CTCA to predict major adverse cardiac events (MACE) in patients presenting to the ED with suspected ACS. All studies had to report MACE for at least 30 day follow-up.

Methods

Table I: Summary of review methods

Population	Adults presenting to the Emergency Department with suspected Acute Coronary Syndrome
Intervention	Exercise ECG or CT Coronary Angiography
Comparators	N/A
Outcomes	MACE, defined as including at least cardiac death and non-fatal MI (individually or as a composite)
Study type	Studies examining the prognostic accuracy of ExECG or CTCA for at least 30-days follow-up for MACE.
Literature searching	November 2010. Major electronic databases – MEDLINE, EMBASE, WoS, Cochrane Library and others.
Number of included studies	13 prognostic studies of ExECG. 7 prognostic studies of CTCA, 1 prognostic study of CT coronary artery calcium (CAC) scoring.
Data extraction	Standardised data extraction form used. Data extraction undertaken by one reviewer and checked by a second.
Quality assessment	The quality assessment was conducted using an adapted version of the framework described by Altman et al. (2)
Analysis	Data was tabulated and meta-analysis conducted for CTCA and ExECG outcomes for MACE.

Meta-analysis

Meta-analysis found, for CTCA, a relative risk for MACE of 3.1 (0.3-18.7) for positive and intermediate scans versus negative scans and 5.8 (0.6-24.5) for positive versus intermediate and negative scans. For ExECG, an increased risk for MACE of 8.4 (3.1-17.3) for positive and inconclusive versus negative tests and 8.0 (2.3-22.4) for positive versus inconclusive and negative tests was found.

References:

- (1) Goodacre S, Cross E, Arnold J, Angelini K, Capewell S, Nicholl J. The health care burden of acute chest pain. *Heart* 2005;91:229-30.
- (2) Altman DG. Systematic reviews of evaluations of prognostic variables. *BMJ* 323, 224-228, 28-7-2001.

A complete list of references for all included studies is available on request.

Results:

Table II: Summary of study characteristics

	CTCA (N=8)	Exercise ECG (N=13)
Sample Size	Ns: 30 to 588	28 to 1000
Range		
Age Range (Mean)	46 to 56 years	35 to 60 years
Duration of follow-up	30 days to > 1 year	30 days to > 1 year

The diagnostic classification for CTCA either dichotomised scans into obstructive (>50% stenosis) or non-obstructive (<50%), or limited positive scans to those with stenosis >70% and used an intermediate category for stenosis of 26-69 or 50-70%.

Table III: Summary of MACE outcomes for CTCA studies

Paper	Positive CTCA	Intermediate CTCA	Negative CTCA
Goldstein 2007	0/8	0/24	0/67
Hollander 2009a	N/R	N/R	1/481
Hollander 2009b	0/13	0/41	0/508
Shuman 2010	N/R	N/R	0/70
Rubinshtein 2007	13/23	1/20	0/15
Miller 2011	0/18	-	0/10
Schlett 2011	20/68	5/117	0/183

Table IV: Summary of MACE outcomes for ExECG studies

Paper	Outcomes	Positive	Inconclusive	Negative
Amsterdam 2002	Revasc. Death	12/114 4/114	7/192 0/192	0/582 1/582
De Filippi 2001	Revasc, death, MI	5/9	Reported with negatives	1/110
Dierks 2000	Revasc, death, MI, cardioshock, heart failure, arrhythmia	7/19	9/267	5/456
Gomez 1996	Death, MI	0/2	0/1	0/41
Goodacre 2005	Revasc, MI, death MI MI, LTA, death only	9/37 1/37	Reported with positives	4/385 3/385
Jeetley 2006	Revasc, MI, death/MI Death/MI	9/27 1/27	11/79 2/79	0/39 2/39
Kerns 1993	MI, death	0	0	0/32
Kirk 1998	Revasc	6/28	0/55	0/118
Lewis 1994	AMI	1/12	0/22	0/59
Polanczyk 1998	PTCA, CABG, MI	12/81	Reported with positives	4/195
Ramakrishna 2005	MI, heart failure	3/37	Reported with positives	0/88
Sarullo 2000	Cardiac death AMI PTCA CABG	0/57 1/57 29/57 15/57	0/22 0/22 0/22 0/22	0/111 0/111 0/111 0/111
Tsakonis 1991	Cardiac events	0/4	-	0/19

Conclusions

MACE rates were low in patients with negative tests, and generally modest in patients with positive tests. Many were process events (Percutaneous Coronary Intervention or Coronary Artery Bypass Graft). This may reflect physicians acting upon positive results. Low overall event rates may be a result of selected low risk study populations.

CTCA and ExECG offer potentially useful non-invasive methods to stratify risk in patients with suspected ACS. However, the evidence is currently insufficient to recommend their routine use. Larger trials generating more events are needed.

Contact

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