Prehospital 12-lead electrocardiography impact on acute myocardial infarction treatment times and mortality: a systematic review

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CRD summary
This review concluded that the use of 12-lead pre-hospital electrocardiography with advance hospital notification, for patients with suspected acute myocardial infarction, reduces deaths in comparison with standard care though the time from arrival at hospital to receiving treatment may be reduced. The authors state that the findings should be treated with caution, owing to the poor-quality evidence available. These conclusions are appropriate.

Authors' objectives
To investigate whether all-cause mortality or time to treatment were improved with the use of 12-lead pre-hospital electrocardiography (PHECG) and advance emergency department (ED) notification among individuals with suspected acute myocardial infarction (AMI).

Searching
MEDLINE (1985 to 2003), EMBASE (1980 to 2003), Current Contents (1993 to 2003), Dissertation Abstracts (1981 to 2003), the Cochrane Library and the Index to Scientific and Technical Proceedings (1991 to 2003) were searched; the search terms were reported. The reference lists of potentially relevant studies were also screened. Unpublished studies were sought by contacting authors who had published in the field, 12-lead ECG manufacturers and the National Institutes of Health website. Only studies reported in the English language were included.

Study selection
Study designs of evaluations included in the review Studies with a control group were eligible for inclusion.

Specific interventions included in the review Studies comparing PHECG and advance hospital notification with standard emergency medical service care were eligible for inclusion. In the included studies PHECG was conducted by a paramedic, or in one study a paramedic or a nurse, and interpreted by an emergency physician, a paramedic or by computer.

Participants included in the review Patients with suspected AMI were eligible for inclusion. The included studies were conducted in urban, rural or mixed settings.

Outcomes assessed in the review The primary outcomes assessed were all-cause in-hospital mortality and time intervals such as time of symptom onset to treatment, on-scene time interval and time to treatment from arrival in the ED.

How were decisions on the relevance of primary studies made? Two authors independently screened studies, blinded to the author, year of publication, journal, results and conclusions. Any disagreements were resolved by consensus. Agreement between reviewers was assessed using a weighted kappa statistic and was found to be 0.61 (standard error, SE=0.045) for titles, 0.63 (SE=0.051) for abstracts and 0.79 (SE=0.146) for full articles.

Assessment of study quality Quality was assessed using the Detsky validity scale for randomised controlled trials (see Other Publications of Related Interest).
Two authors independently assessed study quality, blinded to the journal, author and date of publication. The studies were awarded a score from 1 to 15.

**Data extraction**
Two authors independently extracted the data. The data extraction was then sent to the primary study authors for them to check for accuracy and provide additional information.

**Methods of synthesis**

**How were the studies combined?**
The studies were combined in a random-effects meta-analysis to estimate the pooled weighted mean difference (WMD) and 95% confidence interval (CI).

**How were differences between studies investigated?**
Statistical heterogeneity was investigated using the Cochran Q statistic (P<0.05 was defined as statistically significant). A subgroup analysis to compare urban with rural study sites and paramedic with physician provider and interpretation of the PHECG results was planned.

**Results of the review**
Five studies were included: one randomised controlled trial, three non-randomised controlled studies with a concurrent control group, and one non-randomised controlled study with an historical control group. The total number of participants was unclear.

The studies were generally of a poor quality. The mean quality rating scores given by each reviewer were 6 and 5.5 out of a maximum possible score of 15. Common problems included the lack of randomisation and the use of historical or concurrent controls.

Mortality: only one study reported this outcome. There was no statistically significant difference in mortality between the group receiving PHECG and advance hospital notification and those receiving standard care (8.4% and 15.6% mortality, respectively; P=0.22).

Time intervals: there was no statistically significant difference between intervention and control for the on-scene time interval (3 studies; WMD 1.19 minutes, 95% CI: -0.84, 3.21). There was no evidence of statistical heterogeneity. The time to treatment from arrival in the ED was shorter in the intervention group than in the standard care control group (3 studies; WMD 36.1 minutes, 95% CI: -63.0, -9.27). There was statistically significant heterogeneity.

There were insufficient data to conduct the planned sensitivity analysis.

**Authors' conclusions**
There are insufficient data to determine whether PHECG with advance ED notification, for patients with suspected AMI, reduces in-hospital mortality compared with standard care. The intervention may not extend the pre-hospital scene time and may reduce time to treatment from arrival in the ED, though these findings should be treated with caution given the poor design quality, small sample sizes and heterogeneity.

**CRD commentary**
The review addressed a clear research question using defined inclusion criteria. Relevant databases were searched and unpublished data were sought. Non-English language papers were not included, therefore relevant studies might have been missed. The review methodology was well described and included measures to avoid the introduction of error and bias. Quality was assessed, though the authors reported that the instrument they used had limitations in assessing the quality of randomised studies. Statistical heterogeneity was assessed, although given the limited data available it was not possible to investigate the sources of this heterogeneity. Poor reporting of the primary studies prevented the authors...
from investigating clinical heterogeneity. It would have been more appropriate to have used hazard ratios for time to event data instead of WMDs. The authors' conclusions are appropriately cautious given the limitations of the evidence available.

**Implications of the review for practice and research**

**Practice:** The authors did not state any implications for practice.

**Research:** The authors stated that future research should assess 12-lead PHECG and advance ED notification with in-hospital fibrinolysis or percutaneous coronary intervention in comparison with pre-hospital fibrinolysis in urban and rural settings. In particular, research on the impact on mortality, as well as stroke or reinfarction, and treatment time intervals is required. In addition, the safety and effectiveness of using different levels of providers to administer PHECG, fibrinolytic checklist and advance ED notification should be investigated.

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**Other publications of related interest**


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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.