Automatic external defibrillators: changing the way we manage ventricular fibrillation

Authors' objectives
To discuss recent developments in automatic defibrillation and to review the evidence that first-responders equipped with automatic external defibrillators improve survival from out-of-hospital cardiac arrest.

Searching
Articles published in the English language were sought in MEDLINE (1966 to 1999) using the following keywords: 'cardiac arrest', 'automatic external defibrillators', 'defibrillators', 'first-responder', emergency medical technician' and 'emergency medical services'. Bibliographies of retrieved articles were examined. Studies published only as abstracts were excluded.

Study selection
Study designs of evaluations included in the review
Included studies were of the following designs: prospective cohort with historical control; prospective randomised controlled trial (RCT) with randomisation by time period; prospective controlled trial; and prospective controlled trial with randomisation of communities.

Specific interventions included in the review
The out-of-hospital use of automatic external defibrillators (AED) by first-responders or emergency medical technicians was compared to the use of basic life support. First-responders included police and fire officers.

Participants included in the review
Individuals with witnessed and unwitnessed ventricular fibrillation (VF) from presumed cardiac arrest were included.

Outcomes assessed in the review
Survival to hospital discharge from VF was assessed.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the reviewers performed the selection.

Assessment of study quality
Some aspects of validity were discussed though no formal assessment of validity was undertaken.

Data extraction
Tables report the following data: author; year of publication; location; study design; type of control; and percentage survival by intervention group. Unadjusted odds ratios (OR) and 95% confidence intervals (CI) were calculated for survival. The authors do not state how data were extracted for the review, or how many of the reviewers performed the data extraction.

Methods of synthesis
How were the studies combined?
The DerSimonian and Laird random-effects model was used to estimate summary OR and 95% CI (see Other Publications of Related Interest no.1).

How were differences between studies investigated?
Differences were discussed and statistical heterogeneity was assessed using the Q statistic.

Results of the review
The six included studies were of the following designs: two RCTs (399 patients); two controlled trials (567 patients); one prospective cohort with historical control (207 patients); and one retrospective cohort with historical control (62 patients). Number of patients represents total number of patients in studies.

Most of the studies lacked power to detect differences in survival rates. None of the studies performed randomisation at the individual patient level. A Hawthorn effect was apparent in one study with historical control. Three studies were deliberately set in areas where paramedic responses were prolonged thus decreasing the external validity of these studies.

Equipping first-responders with AEDs increases the probability of survival to hospital discharge after out-of-hospital cardiac arrest. OR = 1.74 (95% CI: 1.27, 2.38; P < 0.001).

There was evidence of some statistical heterogeneity between studies. Percentage survival without use of AEDs ranged from 4% to 19% and survival with use of AEDs ranged from 6.5% to 30%. Heterogeneity Q = 3.50 on five degrees of freedom (P = 0.62).

Differences between studies included: time interval between collapse and contacting medical services; rates of bystander resuscitation; response time for first-responders; and organisation of medical care.

Authors' conclusions
Meta-analysis suggests that equipping first-responders with AEDs increases the probability of survival to hospital discharge after out-of-hospital cardiac arrest. However, most of the studies lacked sufficient power to draw definite conclusions. Until the impact of wide deployment of AEDs is fully understood, first-responder defibrillation in Australia should only occur as part of coordinated multicentre research studies.

CRD commentary
The aims were stated and inclusion criteria defined in terms of participants, intervention and outcomes. By restricting the search to articles published in the English language and identified in one database, other relevant studies may have been omitted. No attempt was made to locate unpublished studies thus raising the possibility of publication bias. No details were given of methods used to select primary studies or extract data. Validity was not formally assessed though comment was made on some aspects of validity. Some relevant information on the included studies was presented in tabular format. Statistical heterogeneity was assessed and differences between studies were discussed. Comment was made on methodological flaws present in the primary studies. Unadjusted odds ratios were pooled regardless of study design and validity. An examination of the influence of confounding factors using adjusted odds ratios may have provided evidence of stability of the results. The discussion includes consideration of factors to be considered when equipping first-responders with AEDs.

In view of the limited search and lack of validity assessment, caution is required when considering the results of this review.

Implications of the review for practice and research
Practice: The authors report that until the impact of wide deployment of AEDs is fully understood, first-responder defibrillation in Australia should only occur as part of coordinated multicentre research studies.

Research: The authors report that the requirement for and potential benefit of public access defibrillation needs to be considered at local level, as does the most frequent location of cardiac arrests.

Bibliographic details

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Other publications of related interest

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Record Status
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.