Delayed versus immediate defibrillation for out-of-hospital cardiac arrest due to ventricular fibrillation: a systematic review and meta-analysis of randomised controlled trials

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CRD summary
This generally well-conducted review concluded that delaying initial defibrillation to allow a short period of cardiopulmonary resuscitation in out-of-hospital cardiac arrest due to ventricular defibrillation demonstrated no benefit or harm over immediate defibrillation for survival to hospital discharge, irrespective of response time. These conclusions appear likely to be reliable.

Authors' objectives
To compare the effect of delayed defibrillation preceded by cardiopulmonary resuscitation (CPR) with immediate defibrillation on survival to hospital discharge.

Searching
MEDLINE, EMBASE, the Cochrane Central Register of Controlled Trials (CENTRAL) and the Cochrane Database of Systematic Reviews were searched to October 2009 for studies published in English; search terms were reported in an online appendix. Reference lists of relevant articles were scanned and authors of the included studies were contacted to identify further studies.

Study selection
Randomised or pseudo-randomised parallel group trials of cardiopulmonary resuscitation (for between 90 to 180 seconds) before defibrillation that reported survival up to hospital discharge as the primary outcome were eligible of inclusion.

All the included trials were of adults with non-traumatic cardiac arrest in an out-of-hospital setting. Mean ages in the trials ranged from 62 to 71 years. The duration of cardiopulmonary resuscitation prior to initial defibrillation was 90 seconds in one trial and 180 seconds in two trials. Some patients also received adrenaline or anti-arrhythmic therapy. Control groups received immediate defibrillation. Mean response times ranged from 7.4 to 12 minutes. Two trials took place in Australia and one in Norway.

Two reviewers independently selected studies for inclusion, with disagreements resolved by a third reviewer.

Assessment of study quality
Risk of bias was evaluated using a tool recommended by the Cochrane Collaboration which assessed randomisation sequence generation, allocation concealment, blinding, incomplete outcome data, selective outcome reporting, and other potential threats to validity.

Two reviewers independently appraised trial quality, with disagreements resolved by a third reviewer.

Data extraction
Two reviewers independently extracted data to calculate odds ratios (OR) with 95% confidence intervals (CI).

Methods of synthesis
Meta-analyses were performed to calculate pooled odds ratios, using a random-effects model. Heterogeneity was assessed using the $\chi^2$ and $I^2$. Subgroup analyses examining response time were conducted.

Results of the review
Three trials were included in the review (n=658 patients). There was a low risk of bias across the trials. All the trials were rated as being of good methodological quality, although details on the method of sequence generation were unclear in two trials, and one trial used a pseudo-randomised method.
There was no benefit from providing cardiopulmonary resuscitation prior to defibrillation compared with immediate defibrillation for survival up to hospital discharge (OR 0.94, 95% CI 0.46 to 1.94; I²=49%; three trials). Subgroup analysis according to ambulance response time (up to five minutes or over five minutes) also produced no significant differences in survival rates. However, the analysis for over five minutes was subject to significant heterogeneity in the Norwegian study which suggested significant benefit favouring cardiopulmonary resuscitation, but the (pooled) Australian trials indicated no significant difference.

Authors' conclusions
Delaying initial defibrillation to allow a short period of cardiopulmonary resuscitation in out-of-hospital cardiac arrest due to ventricular defibrillation demonstrated no benefit or harm over immediate defibrillation for survival to hospital discharge, irrespective of response time.

CRD commentary
The review addressed a clear question and was supported by appropriate inclusion criteria. Attempts to identify relevant studies were undertaken by searching electronic databases and other methods, although the restriction to including only studies published in English meant that relevant studies may have been missed (and the review may have been subject to publication or language bias). Suitable methods were employed to reduce the risks of reviewer error and bias for all relevant review processes.

Trial quality was assessed and was used to interpret the results of the review. Sufficient trial details were provided. Appropriate methods were used to pool data and evaluate heterogeneity.

Despite the fact that relevant studies may have been missed, the review was otherwise generally well conducted, so the authors' conclusions appear likely to be reliable.

Implications of the review for practice and research
Practice: The authors stated that, based on the available evidence, there was justification for continuing with current practice using either defibrillation strategy.

Research: The authors stated that future trials were warranted which enrolled sufficient patients in each relevant subgroup according to response time to definitively answer the question of early versus delayed defibrillation in brief versus prolonged cardiac arrest.

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