Implantable cardioverter defibrillator therapy in chronic kidney disease: a meta-analysis

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CRD summary
The authors concluded that data suggested that chronic renal disease was associated with increased mortality in patients who received implantable cardioverter defibrillator therapy. The authors’ cautious conclusions appear to reflect the evidence from the included observational studies and are likely to be reliable.

Authors' objectives
To examine the effect of renal dysfunction on mortality in patients with implantable cardioverter-defibrillator (ICD).

Searching
MEDLINE, EMBASE and Cochrane Central Register of Controlled Trials (CENTRAL) were searched from inception to December 2008. Search terms were reported. Reference lists of reviews and identified studies were screened. Abstracts of scientific sessions of American College of Cardiology, American Heart Association, European Society of Cardiology and North American Society of Pacing and Electrophysiology were screened for the previous five years. Studies published as only as abstracts were excluded.

Study selection
Prospective and retrospective observational studies were eligible if they analysed the association between chronic renal disease and all-cause mortality in patients with ICDs, evaluated renal function and had a follow-up duration of at least one year. The primary review outcome was all-cause mortality.

Studies used different measures to define chronic renal disease and the reviewers accepted the authors’ definitions; these included estimations of glomerular filtration rate (GFR), serum creatinine and dialysis dependence. In most studies patients had primary and secondary indications for ICD. Mean age ranged from 53 to 82 years. The proportion of males ranged from 71% to 100%.

Two reviewers independently selected studies and resolved disagreements on inclusions by discussion or consensus with a third reviewer.

Assessment of study quality
Validity was assessed using criteria derived from United States Preventative Task Force and Evidence-Based Medicine Working Group: clear inclusion and exclusion criteria; study sample representative of targeted population; explanation of sample selection; full details of clinical and demographic variables; follow-up of at least one year; losses to follow-up reported; definition of chronic renal disease; clear definition of outcomes and outcome assessment; renal function measured at baseline; and adjustment for potential confounders in multivariate analysis. Studies were considered low quality if they met fewer than five criteria, fair quality if they met between five and seven criteria and good quality if they met more than eight criteria.

It was unclear how many reviewers assessed validity.

Data extraction
Two blinded reviewers independently extracted all-cause mortality as adjusted hazard ratios (HRs) or odds ratios (ORs) with 95% confidence intervals (CIs); data for the most complete adjustment for potential confounders were extracted. Odds ratios were assumed to be a valid approximation for hazard ratios. Hazard ratios and odds ratios were transformed by taking their logarithms and standard errors were calculated from log hazard ratios or log odds ratios and corresponding CIs.

Disagreements were resolved by consensus with a third reviewer. If required, study authors were contacted for missing data.
Methods of synthesis

Pooled hazard ratios and 95% CIs were calculated using fixed-effect models (in the absence of significant heterogeneity) or a random-effects model (where there was significant heterogeneity). Heterogeneity was assessed using $\chi^2$ and the $I^2$ statistics; $I^2>56\%$ indicated significant heterogeneity.

Sensitivity analyses omitted studies that presented mortality data as adjusted odds ratios. Pre-specified subgroup analysis was used to analyse studies that used an estimated glomerular filtration rate less than $60\text{mL/min/1.73m}^2$ to define chronic renal disease. The possibility of publication bias was explored using a funnel plot.

Results of the review

Eleven observational studies were included ($n=3,010$). These included two prospective and nine retrospective studies. Ten studies were considered to be good quality and one was rated as fair. Follow-up ranged from one to four years. All of the included studies adjusted for confounding factors such as age, gender, comorbidities, medications and ejection fraction.

Chronic renal disease was associated with a statistically significant increase in all-cause mortality (HR 3.44, 95% CI 2.82 to 4.21; 11 studies, 12 comparisons). No significant heterogeneity was found.

Results were similar for the subgroup of patients with estimated glomerular filtration rate less than $60\text{mL/min/1.73m}^2$ and for the sensitivity analyses.

The funnel plot suggested potential for publication bias, but was difficult to interpret due to the small number of studies.

Authors’ conclusions

Data suggested that chronic renal disease was associated with increased mortality in patients who received implantable cardioverter defibrillator therapy.

CRD commentary

The review question was clearly stated and inclusion criteria were appropriately defined. Several relevant sources were searched. No attempts were made to minimise publication bias and it was unclear whether any language restrictions were applied. Potential for publication bias was assessed but this was of limited value due to the small number of studies. Methods were used to minimise reviewer errors and bias in study selection and data extraction; it was unclear whether similar steps were taken during validity assessment. Study validity was assessed, but only an overall rating was reported. Appropriate methods were used for the meta-analyses. Heterogeneity was assessed. Predefined subgroup and sensitivity analyses were conducted.

The authors’ cautious conclusions appeared to reflect the evidence from the included observational studies and are likely to be reliable.

Implications of the review for practice and research

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

Research: The authors stated that there was a need for prospective studies to assess the risk of different stages of chronic renal disease in patients who received ICD therapy and an urgent need for better stratification of risks of candidates for ICD therapy.

Funding

Not stated.
Bibliographic details

PubMedID
19812050

DOI
10.1093/europace/eup282

Original Paper URL
http://europace.oxfordjournals.org/content/11/11/1469.abstract

Indexing Status
Subject indexing assigned by NLM

MeSH
Arrhythmias, Cardiac /mortality /prevention & control; Comorbidity; Defibrillators, Implantable /utilization; Electric Countershock /instrumentation /mortality /utilization; Female; Heart Failure /mortality /prevention & control; Humans; Kidney Failure, Chronic /mortality; Male; Risk Assessment /methods; Risk Factors; Survival Analysis; Survival Rate

AccessionNumber
12010000068

Date bibliographic record published
14/04/2010

Date abstract record published
02/02/2011

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.