Meta-analysis of randomized controlled trials comparing isolated left ventricular and biventricular pacing in patients with chronic heart failure

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CRD summary
This review concluded that left ventricular pacing achieved similar improvement in clinical status to biventricular pacing in patients with chronic heart failure. The authors' conclusions did not fully reflect the limitations of the evidence presented (a small number of trials and participants that provided no evidence of a difference rather than evidence of no difference) and appear somewhat overstated.

Authors' objectives
To examine the effect of left ventricular pacing versus biventricular pacing on clinical status, left ventricular systolic function and left ventricular remodelling in patients with chronic heart failure.

Searching
MEDLINE (January 1948 to January 2011), EMBASE (1991 to last quarter of 2010) and Cochrane Central Register of Controlled Trials (CENTRAL) (first quarter of 2011) were searched. Search terms were reported. Reference lists of identified studies and relevant review articles, editorials, commentaries and proceedings of international cardiology meetings were searched. No language restrictions were applied.

Study selection
Randomised controlled trials (RCTs) that compared left ventricular pacing with biventricular pacing in patients with left ventricular systolic dysfunction and wide QRS duration were eligible for inclusion.

Outcome measures included improvement in clinical status (New York Heart Association class, six-minute walk distance, peak oxygen consumption and quality of life scores) and/or left ventricular function (left ventricular ejection fraction) and/or left ventricular remodelling (left ventricular end-systolic volume). Trials with fewer than 15 participants in total were excluded.

Mean participant age ranged from 62 to 72 years. Most participants in the trials were in New York Heart Association Class III. Left ventricular ejection fraction ranged from 21% to 26%. Participants who were taking angiotension-converting enzyme inhibitors/angiotensin receptor blockers ranged from 81% to 100% and beta blockers ranged from 39% to 100%.

The authors did not state how the papers were selected for the review.

Assessment of study quality
Two reviewers assessed the methodological quality of the studies using the Cochrane Risk of Bias tool which included sequence generation, allocation concealment, blinding, incomplete outcome data, selected reporting and other bias. Any discrepancies were resolved by consensus with a third reviewer.

Data extraction
Data were extracted to derive mean differences with their 95% confidence intervals (CI) for continuous outcomes or odds ratios for dichotomous outcomes.

Two reviewers independently extracted data. Any disagreements were resolved by consensus with a third reviewer.

Methods of synthesis
Pooled weighted mean differences (WMDs), odds ratios and their corresponding 95% CIs were calculated using fixed-effect meta-analysis (where there was no evidence of heterogeneity) or a random-effects model was used. Heterogeneity was assessed using $X^2$ and $I^2$ ($p<0.10$ for $X^2$ and $I^2>50\%$ were considered evidence of heterogeneity). When heterogeneity was identified, sensitivity analysis was performed by excluding individual studies one at a time and
recalculating the pooled estimate for the remaining studies.

Publication bias was assessed using Egger's and Begg's tests.

**Results of the review**

Five RCTs were included in the review (574 participants, range 18 to 306). Two trials were single blinded and three trials were double blinded. Allocation concealment was adequate in two trials. All five trials were free of selective reporting, incomplete outcome data and other bias. There was no evidence of publication bias.

Four of the five included studies were parallel randomised trials and one was a crossover randomised trial. Follow-up ranged from two months to twelve months.

Meta-analysis showed no significant differences between left ventricular pacing and biventricular pacing in six-minute walk distance, quality of life improvement, peak oxygen consumption and New York Heart Association Class. There were discrepancies between the text and forest plots for New York Heart Association Class and quality of life improvement.

Pooled results for left ventricular ejection fraction (WMD 1.28, 95% CI -0.11 to 2.68, p=0.07) and left ventricular end-systolic volume (WMD -5.73, 95% CI -11.86 to 0.39, p=0.07) favoured biventricular pacing but the differences did not reach statistical significance.

Substantial heterogeneity was observed in New York Heart Association Class (I²=80%) and the authors performed a sensitivity analysis.

**Authors' conclusions**

Left ventricular pacing achieved similar improvement in clinical status as biventricular pacing in patients with chronic heart failure but there was a trend towards superiority of biventricular pacing over left ventricular pacing for left ventricular reverse modelling and systolic function.

**CRD commentary**

The review question and inclusion criteria were clear. Search terms were reported. No language restrictions were applied, which reduced potential language bias. The authors found no evidence of publication bias. Two authors were involved in study data extraction and quality assessment, which minimised potential error and bias. The authors did not state how many reviewers were involved in screening and selecting relevant studies.

Quality assessment using the Cochrane Risk of Bias tool indicated that the trials were generally good quality. Studies were pooled by meta-analysis using standard methods. Statistical heterogeneity was assessed and explored using sensitivity analysis, which was appropriate. However, statistical pooling of studies of different length of follow-up may not have been appropriate (acknowledged by the authors).

The authors' conclusions did not fully reflect the limitations of the evidence presented (a small number of trials and participants that provided no evidence of a difference rather than evidence of no difference) and appear somewhat overstated.

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

The authors did not state any implications for practice or further research.

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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.