Conduction System Pacing Versus Biventricular Pacing for Cardiac Resynchronization Therapy: A Systematic Review and Meta-analysis of Randomized Trials

Authors: Saif-Eddin Dabour MD, Elmustafa Hamad, Abdullah Kouli, Diya Asad MD, Muhammad Mian MD, Sana Tahir MD, Devender Akula MD FHRS

Background

Randomized comparisons of conduction system pacing (CSP) versus biventricular pacing (BiVP) for cardiac resynchronization therapy (CRT) have yielded heterogeneous results across pacing modalities and trial populations. We performed a randomized trial-only systematic review and meta-analysis to evaluate short-term remodeling and electrical outcomes with CSP versus BiVP.

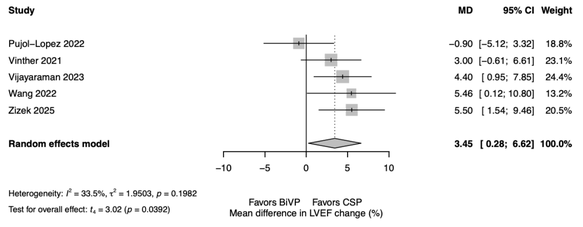
Methods

We searched PubMed, Embase, and Cochrane CENTRAL for randomized controlled trials comparing CSP-based CRT with BiVP in adults with heart failure or CRT-eligible wide-QRS phenotypes. The main prespecified quantitative remodeling analysis was absolute change in left ventricular ejection fraction (LVEF) at approximately 6 months using directly reported randomized-group change scores. A supportive 6-month LVEF model incorporated imputed change standard deviations when required, using an empirically derived within-person correlation coefficient (r = 0.659). QRS duration at approximately 6 months was the main secondary electrical outcome. Exploratory overlap-safe pooled analyses assessed procedural success, crossover, and complications.

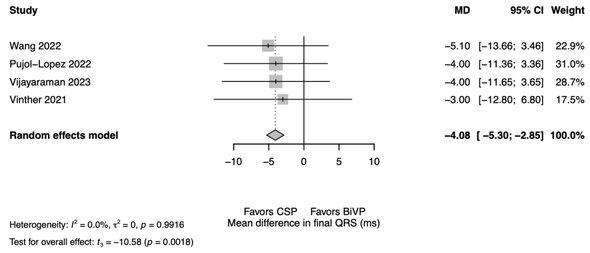
Results

Nine randomized studies were included in the qualitative synthesis, and 7 contributed to at least one quantitative analysis (695 patients; 348 CSP, 347 BiVP). In the primary 6-month direct-change model, CSP was associated with greater improvement in LVEF versus BiVP (mean difference [MD] 3.45%, 95% confidence interval [CI] 0.28 to 6.62; p = 0.039). In the supportive 6-month imputed-variance model (6 study contributions), the pooled estimate was similar (MD 4.08%, 95% CI 1.60 to 6.56; p = 0.008). QRS duration at approximately 6 months was shorter with CSP across 4 studies (MD -4.08 ms, 95% CI -5.30 to -2.85; p = 0.0018). Exploratory pooled analyses showed no significant differences in procedural success, crossover, or complications.

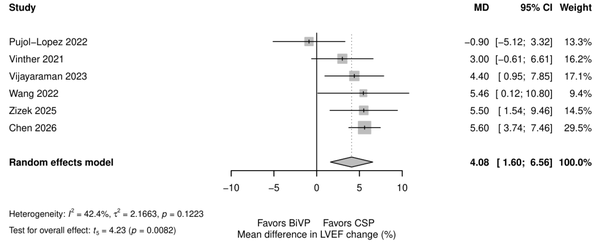
Primary 6-month LVEF change



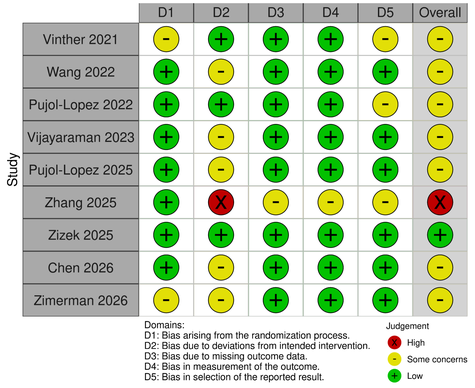
QRS duration at approximately 6 months



Supportive 6-month LVEF change-score analysis



Cochrane's Risk of bias (RoB 2) summary



Conclusion

In randomized trials, CSP was associated with improved short-term remodeling and shorter QRS duration compared with BiVP. However, the evidence base remains small and heterogeneous, and clinical-event data remain limited, supporting cautious interpretation.