Approach to the catheter ablation technique of paroxysmal and persistent atrial fibrillation: a meta-analysis of the randomized controlled trials

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CRD summary
The review concluded that the addition of ablations beyond pulmonary vein ablation appeared to be necessary for persistent atrial fibrillation but not proven for paroxysmal atrial fibrillation; the optimal technique required further study. While the authors’ conclusion follows from the results presented, the possibility of publication bias should be considered.

Authors' objectives
To evaluate the current approach to catheter ablation in paroxysmal and persistent atrial fibrillation.

Searching
MEDLINE, EMBASE and Cochrane Central Register of Controlled Trials (CENTRAL) were searched from January 1998 to July 2010. Search limits included randomised controlled trials and studies in English. Search terms were reported for MEDLINE.

Study selection
Randomised controlled trials (RCTs) of catheter ablation for atrial fibrillation (involving pulmonary vein ablation with or without isolation) in patients with paroxysmal and/or persistent atrial fibrillation were eligible for inclusion. The primary outcome was freedom from atrial fibrillation after a single procedure. Trials of less than six months follow-up were excluded.

Interventions included: circumferential pulmonary vein ablation isolation; pulmonary vein isolation with or without cavo-tricuspid isthmus line ablation; antral or wide-area pulmonary vein isolation; pulmonary vein isolation or circumferential pulmonary vein ablation with linear lesions; pulmonary vein isolation with or without ablation of complex fractionated electrograms. Comparators and monitoring processes varied across the trials.

Two reviewers independently selected trials for inclusion in the review and any disagreements were resolved by a third reviewer.

Assessment of study quality
The Cochrane Collaboration’s tool for assessing risk of bias was used to evaluate study quality.

One of three reviewers extracted data on methodological aspects of the trial which was checked by a cardiac electrophysiologist.

Data extraction
Data were extracted in order to calculate risk ratios (RRs) or odds ratios (ORs) with 95% confidence intervals (CIs).

One of three reviewers extracted data which was checked by a cardiac electrophysiologist. Where additional information was required, trial authors were contacted.

Methods of synthesis
Summary risk ratios and odds ratios with 95% confidence intervals were estimated using a fixed-effect model or a random-effects model if significant heterogeneity was found. Heterogeneity was assessed using visual examination of forest plots as well as using $I^2$. Separate analyses were performed for paroxysmal and persistent atrial fibrillation where possible. Sensitivity and subgroup analyses were performed.

Results of the review
Thirty-five RCTs were included in the review (4,128 participants). Risk of bias in regard to allocation concealment and
Radiofrequency ablation versus antiarrhythmic drug: Significant differences in favour of radiofrequency ablation were found for paroxysmal (RR 2.26, 95% CI 1.74 to 2.94; I²=0%; six RCTs) and persistent atrial fibrillation (RR 3.20, 95% CI 1.29 to 8.41; I²=74%; five RCTs) for maintenance of sinus rhythm. The inclusion of one particular RCT was purported to account for the much of the heterogeneity found for persistent atrial fibrillation. A significant difference in favour of paroxysmal circumferential pulmonary vein ablation (RR 4.65, 95% CI 2.32 to 9.31; I²=52%; two RCTs) compared with antiarrhythmic drugs was also found.

When specific techniques were examined: Wide area pulmonary vein isolation was found to significantly reduce risk of paroxysmal (RR 0.78, 95% CI 0.63 to 0.97; I²=40%; six RCTs) and persistent atrial fibrillation (RR 0.64, 95% CI 0.43 to 0.94; I²=37%; three RCTs) compared with segmental pulmonary vein isolation. Pulmonary vein isolation/circumferential pulmonary vein ablation with linear lesions was found to reduce risk of persistent (RR 0.53, 95% CI 0.32 to 0.87; I²=75%; four RCTs) and paroxysmal (RR 0.93, 95% CI 0.88 to 0.99; I²=0%; eight RCTs) atrial fibrillation compared with pulmonary vein isolation/circumferential pulmonary vein ablation alone. Pulmonary vein isolation with complex fractionated electrogram was found to reduce significantly risk of persistent atrial fibrillation compared with pulmonary vein isolation alone (OR 0.53, 95% CI 0.30 to 0.93; I²=39%; three RCTs); no significant between group difference was found for paroxysmal atrial fibrillation.

Incidence of complications was also reported.

Authors' conclusions
It appeared that the addition of ablations beyond pulmonary vein isolation were necessary for persistent atrial fibrillation but not proven for paroxysmal atrial fibrillation. The optimal technique for persistent atrial fibrillation required further study.

CRD commentary
The review question was supported by clearly defined inclusion criteria. Three relevant electronic databases were searched. This search was restricted by language and no attempt was made to locate unpublished articles so language and publication bias could not be ruled out. Appropriate steps were taken to minimise the likelihood of error or bias in the selection of trials, data extraction and validity assessment.

Methodological quality was assessed using appropriate criteria but individual trial results were unavailable. The authors reported, in general, on two aspects of study validity. Standard meta-analytic procedures were performed; heterogeneity was assessed and subgroup analyses performed. The authors' conclusion followed from the results presented but the possibility of publication bias should be considered.

Implications of the review for practice and research
Practice: The authors stated that catheter ablation was the best form of rhythm control available for the treatment of symptomatic drug refractory atrial fibrillation but that techniques of catheter ablation should be tailored to the patient and their type of atrial fibrillation.

Research: The authors stated that further well-conducted trials in atrial fibrillation ablation were needed to determine the optimal techniques, particularly in persistent atrial fibrillation.

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