Short-term Heart functional changes of Catheter Ablation in persistent atrial fibrillation & Heart Failure: A meta-analysis trials of randomized controlled

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Abstract

Background: The effect of catheter ablation (CA) versus drug therapy on cardiac function improvement is not clear for patients with persistent atrial fibrillation and heart failure. To compare the short-term therapeutic effects between CA and conventional drug therapy, we conducted a meta-analysis of the current randomized controlled trials (RCTs).

Objective and Methods: The analyses systematically collected PubMed, Embase, and the Cochrane Library for RCTs comparing catheter ablation with medical therapy in patients with persistent atrial fibrillation and heart failure. In order to reduce the impact of other factors on cardiac function, we limited the maximum follow-up time to two years. The primary outcome is changes in left ventricular ejection fraction (LEVF), second outcomes are changes in 6-minute walk test (6MWT), Minnesota Living with Heart Failure Score (MLHFQ), B-type natriuretic peptide (BNP). SMD was used for the results measured by different methods. Random-effects model or fixed-effects model was used to estimate relative risks (RRs) with 95% confidence intervals (CIs).

Results: A total of six randomized controlled trials included 775 patients included in the final analysis, compared with drug therapy, catheter ablation has a better improvement in left ventricular ejection fraction (SMD, 0.57; 95% CI [0.40, 0.94], p<0.00001).

Conclusion: Catheter ablation has a better improvement than medical treatment in heart function for patients with persistent atrial fibrillation and heart failure.

Keywords: Atrial fibrillation; Heart failure; Catheter ablation

Introduction

Atrial fibrillation (AF) and heart failure (HF) are epidemics of 21st century. The two diseases are often co-existing and affect each other in pathogenesis and prognosis [1-3]. AF in patients with HF is associated with an increased risk of heart function deterioration, leading to a severe limitation of excise toleration and life quality. Considering such poor outcomes for these patients, identifying the optimal therapies is of great importance and urgency.

Antiarrhythmic and heart control drugs have been the cornerstone of atrial fibrillation treatment and are recommended by various guidelines [4-7]. But even treated with optimal drug therapy, most patients' heart function still can't achieve the desired improvement, and long-term drugs also lead to some adverse reactions. Catheter ablation (CA) is a well-established therapy for maintaining sinus rhythm, and it also has positive outcomes in people with HF [8]. But there is lack of study whether it is superior to medicine in improve cardiac function. When evaluating the effects of two treatments, we usually affected by two problems: first, limited research on such issues could be found and existing researches remain controversial [9-15]; second, some studies focus on long-term prognosis, this may lead to a large number of lost follow-up and cardiac function may be affected by the development of other diseases.

Therefore, we conducted a meta-analysis of the existing randomized controlled trials of catheter ablation and traditional drug therapy for the short-term improvement of cardiac function in patients with atrial fibrillation and heart failure, expected to better evaluate the effect of different treatment regimens on cardiac function improvement.

Methods: This meta-analysis was performed mainly according to the recommendations of the Cochrane Handbook and

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PRISMA guidelines, all analyses were based on previous published RCTs. There was no registered protocol for this meta-analysis. No ethical approval and patient consent are required.

Literature search strategy and selection criteria

We systematically searched the published literature in PubMed, Embase and the Cochrane Library from inception through June 10, 2018. The electronic searches were conducted using exploded Medical Subject Headings (MeSH) terms and the corresponding keywords in title/abstract. The search terms used in this meta-analysis were MeSH exp 'Atrial Fibrillation', and keywords 'Auricular Fibrillation', 'fibrillation', 'fibrillations'; MeSH exp ' Heart Failure', and keywords 'Cardiac Failure', 'left ventricular systolic dysfunction', 'reduced left ventricular systolic function'; MeSH exp 'Catheter Ablation' and keywords 'ablation', 'pulmonary vein isolation'; MeSH exp ' Medical Treatment' and keywords 'medical', 'medicine', 'drug'. Only radomized controlled trials (RCTs) in the English were included. Two reviewers (Xiong Q and Chen Y) independently conducted the initial search, deleted duplicate records, screened the titles and abstracts for relevance, and identified records as included, excluded or uncertain. In case of uncertainty, full-text article was acquired to identify eligibility. Doubts and disagreements were solved by a third investigator (Ling Z). Published RCTs meeting the following criteria were included: (1) Population: AF patients with persistent AF and LEVF <50%; (2)The RCT associated with original date on catheter ablation versus medical treatment; (3) If the trial related both persistent AF and paroxysmal AF, only the data about persistent were included; (4) Outcomes should include all or part of the patient's cardiac function related indicators such as left ejection fraction(LEVF), heart failure questionnaire scores, improvement in 6-minute walking test(6-MWT), B-type natriuretic peptide (BNP); (5) The follow-up duration should not less than 6 months but not more than 24 months, if beyond 24monthes,only use data on 24 months; (6) The patient had not received radiofrequency ablation before this treatment.

Data extraction and quality assessment

Data extraction was conducted independently by Xiong Q and Shangguan J. The following information was obtained: first author, year of publication, country, and study population, number of patients, left ventricular ejection fraction, ablation procedural data and followup duration. Additionally, we also reviewed supplementary appendices of included RCTs. Discrepancies during data extraction were resolved by discuss with co-authors. The end point events were related changes in cardiac function such as changes in LEVF, 6MWT, MLHFQ and changes in BNP after different treatments. The qualities of included trials were assessed by the modified jaded scale, which include randomization, allocation concealment, blinding and loss to follow-up. High-quality trials had 4 and more scores.

Assessment of risk of bias in included studies

Risk of bias was independently assessed by two reviewers (Xiong Q and Shangguan J) using the Cochrane risk-of-bias tool. According to the tool, each included trial was reviewed and scored as 'high', 'low', or 'unclear' risk with the following criteria: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting and other bias. Trials with high risk of bias for any domain were considered as at high risk of bias, while trials with low risk of bias for all key domains were considered as at low risk of bias, otherwise they were considered as at unclear risk of bias.

Statistical analysis

Statistical analyses were performed using Review Manager 5.3 (The Nordic Cochrane Centre, The Cochrane Collaboration, 2014). Mean different (MD) with 95% CIs were calculated for all related continuous outcomes. STD Mean different (SMD) were used if the results are measured by different methods. P value <0.05 was considered statistically significant. Heterogeneity across studies was quantified using the I2 statistics [16]. studies with an I2 statistic of 25% to 50% were considered to have low heterogeneity, those with an I2 statistic of 50% to 75% were considered to have moderate heterogeneity and those >75% were considered to have a high degree of heterogeneity. For the meta-analyses with significant heterogeneity, then a random-effect model was used and sensitivity analysis was performed to evaluate the influence of

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single studies on the summary estimates and the consistency of the outcome.

Results

The results of literature search and selection are shown in the PRISMA flowchart (Figure 1). Our initial search yielded 433 records. After removing duplicates and screening the titles and abstracts, 9 articles were thought to be potentially eligible for inclusion. After fulltext review, 6 full-text articles with 775 patients were finally included in this meta-analysis [17-22]. All studies were RCTs. One had a mix patient population with paroxysmal AF, and we only include the persistent AF patients in our analysis.

The main characteristics of 6 included RCTs with 775 patients are shown in Table 1. The population sizes of trials ranged from 41 to 363. A total of 388 patients in CA group and 387 patients in medical therapy group were included in analyses. Most of the RCTs included patients with persistent AF except the trial by Marrouche et al. [17] which enrolled patients with paroxysmal AF. The mean age ranged from 55 to 64 years, and the proportion of men ranged from 77% to 96%, baseline LVEF The results of quality assessment are shown in Table 2; all studies had a jadad score of 5 points. Due to the experimental nature, the blinding method could not be achieved and the quality was reduced, but according to the scoring results, all RCTs had a high quality.

Conclusion

Catheter ablation has a better improvement than medical treatment in heart function for patients with persistent atrial fibrillation and heart failure after a meta-analysis of 6 randomized controlled trials.

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