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ORIGINAL ARTICLE

Comparison of the Outcomes of Monopolar and Bipolar Radiofrequency Ablation in Surgical Treatment of Atrial Fibrillation

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Key words: atrial fibrillation; radiofrequency ablation; cardiac surgery; Maze procedure

Objective To compare the therapeutic effects and safety of monopolar and bipolar radiofrequency (RF) ablation used during cardiac surgery to treat atrial fibrillation.

Methods We retrospectively studied a total of 81 patients with chronic atrial fibrillation who underwent open cardiac surgery with concomitant RF ablation between January 2007 and March 2011. Fifty-eight patients received bipolar RF ablation and 23 received monopolar RF ablation, respectively. The sinus rhythm restoration rate, the procedural duration, the frequency of severe perioperative complications, and mortality were compared between the two groups.

Results The sinus rhythm restoration rate did not differ significantly between the two groups after follow-up of 15.1 ± 12.6 months ($P=0.199$). The frequencies of severe perioperative complications and mortality were also similar in the two groups. The total procedural time using bipolar RF ablation was significantly shorter than that using monopolar ablation (19.7 ± 4.6 minutes vs. 28.1 ± 8.5 minutes, $P < 0.001$).

Conclusions Both monopolar and bipolar RF ablation are safe and effective in treating chronic atrial fibrillation patients during open cardiac surgery, but bipolar RF ablation is more convenient in practice.

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SALINE-IRRIGATED radiofrequency (RF) ablation-modified Maze III surgery is widely used to treat organic heart disease complicated by atrial fibrillation (AF). In China, most surgeries featuring RF ablation continue to employ the monopolar approach, but even continuous endocardial monopolar RF ablation may not successfully yield a uniform transmural effect. In recent years, bipolar ablation systems have been

used to treat entire clamped layers of heart tissue, improving the transmural effect. In the present study, we retrospectively analyzed the outcomes of patients receiving monopolar or bipolar RF ablation to compare the efficacies of the two approaches.

PATIENTS AND METHODS

Patient selection

From January 2007 to March 2011, 81 patients with AF were treated with open cardiac surgery in Zhongshan People's Hospital, including 33 males and 48 females, aged

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18-72 years (mean age: 48.2 ± 24.9 years). All the patients had been diagnosed with rheumatic valvular heart disease and all exhibited AF as measured by 12-lead electrocardiography. Preoperative cardiac function was New York Heart Association (NYHA) class II in 28 cases, class III in 44, and class IV in 9. The mean duration of AF was 23.2 ± 14.6 months (range, 8-42 months). The preoperative left atrial diameter as measured by echocardiography was 57.7 ± 16.3 mm (range, 39-68 mm), and the left ventricular end-diastolic diameter was 45.2 ± 14.1 mm (range, 39-61 mm).

Surgical procedure

Median sternotomy and heparinization were performed after general anesthesia, followed by conventional establishment of a cardiopulmonary bypass. All right pulmonary veins (RPVs) from the inferior to the superior were bluntly dissected under circulation, and all left pulmonary veins (LPVs) were similarly dissected after induction of circulatory arrest. The Marshall ligament was cut and a Medtronic cardioablation RF system was connected to either an ablation pen or an ablation clamp (as appropriate). The LPVs, RPVs, and the left atrial appendage (Figs. 1 and 2) were subjected to ablation. The principal ablation line commenced at the connection of the right superior pulmonary vein to the left superior pulmonary vein, and proceeded as follows: from the right inferior pulmonary veins to the left inferior pulmonary veins; from the lower end of the incision of the interatrial groove to the mitral annulus; from the left atrial appendage to the left superior pulmonary vein; from the incision in the anterior wall of the right atrium to the postcava; the coronary sinus; and the tricuspid ring (Fig. 3). Valve replacement, plasty, and neoplasty proceeded after completion of ablation. A total of 42 patients underwent mitral valve replacement, 11 mitral valvuloplasty, 9 aortic valve replacement, and 19 mitral and aortic valve replacement; 28 received tricuspid valvuloplasty; and 11 received left atrial thrombus clearance.

Postoperative management

A temporary pacing wire was routinely placed in the ventricular epicardial surface. Intravenous administration of amiodarone commenced after heart resuscitation, changed to oral amiodarone at 200-400 mg/day on the first day after operation and taken for 6 months. Amiodarone or direct current cardioversion was used to treat patients exhibiting postoperative AF. Warfarin was routinely prescribed after mechanical valve replacement; the international normalized ratio was maintained within 2.0-2.5.

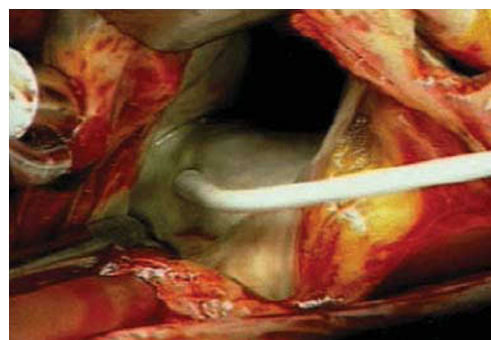


Figure 1. The monopolar approach of radiofrequency ablation treatment.

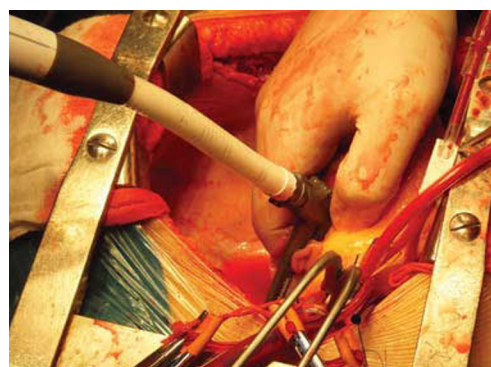


Figure 2. Performance of bipolar ablation in the left atrial appendage.

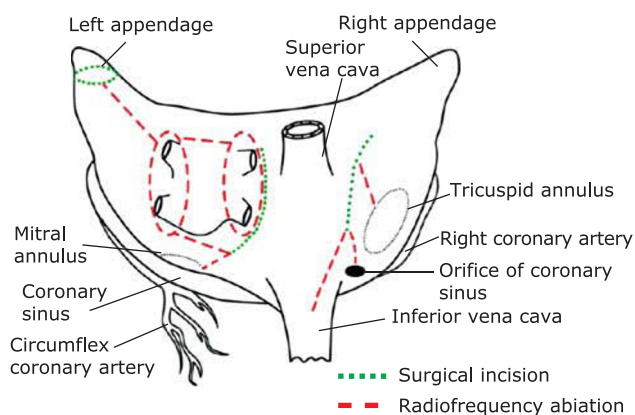


Figure 3. Radiofrequency ablation line.

Statistical analysis

SPSS version 15.0 software was used for all the statistical analysis. Data are expressed as means \pm SD, raw counts, frequencies, or percentages. The significance of inter-group differences was analyzed using the *t*-test and Pearson's χ^2 test. Long-term follow-up data were compared using the Kaplan-Meier method, log-rank test was used to explore survival distributions. $P < 0.05$ was considered statistically significant.

RESULTS

Clinical data

Detailed clinical data of the patients are shown in Table 1.

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