Abstract

Objective To investigate whether the addition of ganglionated plexus ablation on the basis of circumferential pulmonary vein isolation can improve the long-term successful rate of catheter ablation in patients with atrial fibrillation (AF).

Methods From March 2011 to December 2012, 226 patients with paroxysmal or persistent AF who received radiofrequency catheter ablation for the first time in our hospital were reviewed. 123 cases were treated with CPVI (CPVI group) and 103 cases with CPVI plus GP (CPVI+GP group). The date of age, sex, type of atrial fibrillation and left atrial size were collected and compared. All patients were followed up at 3 months, 6 months, 1 year, 1.5 years, 2 years, 2.5 years, 3 years, 3.5 years and 4 years after operation. To compare the difference of the successful rate of operation between CPVI and CPVI+GP groups.

Results Among 226 patients with AF undergoing catheter ablation for the first time, persistent AF accounted for 32.7%, hypertension accounted for 62.8%, diabetes accounted for 21.2%, coronary heart disease accounted for 21.7%, stroke history accounted for 7.5%. The successful rate of operation 3 months after operation was 92.7% in CPVI group and 91.3% in CPVI+GP group, respectively, \( P = 0.807 \); at 6 months, 75.6% in CPVI group, 89.3% in CPVI+GP group, \( P = 0.009 \); at 1 year, 70.7% in CPVI group, 82.5% in CPVI+GP group, \( P = 0.043 \); at 1.5 years, 65.0% in CPVI group, 77.7% in CPVI+GP group, \( P = 0.041 \); at 2 years, 56.1% in CPVI group, 68.9% in CPVI+GP group, \( P = 0.032 \); at 2.5 years, 48.8% in CPVI group, 66.0% in CPVI+GP group, \( P = 0.011 \); at 3 years, 42.3% in CPVI group, 63.1% in CPVI+GP group, \( P = 0.002 \); at 3.5 years, 39.0% in CPVI group, 61.2% in CPVI+GP group, \( P = 0.001 \); at 4 years, 32.5% in CPVI group, 58.3% in CPVI+GP group, \( P < 0.001 \). The results showed that there was no significant difference in the successful rate of operation between the two groups in 3 months after operation, but the successful rate of operation in CPVI+GP group was significantly higher than that in CPVI+GP group at 6 months, 1 year, 1.5 years, 2 years, 2.5 years, 3 years, 3.5 years, respectively. Subgroup analysis showed that the successful rate of operation in patients with paroxysmal atrial fibrillation at 3 months after operation was 94.1% in CPVI group
and 92.7% in CPVI+GP group, \( P = 0.753 \); at 6 months, 82.1% in CPVI group, 89.7% in CPVI + GP group, \( P = 0.248 \); at 1 year, 77.4% in CPVI group, 82.4% in CPVI + GP group, \( P = 0.545 \); at 1.5 years, 75.0% in CPVI group, 80.9% in CPVI + GP group, \( P = 0.437 \); at 2 years, 70.2% in CPVI group, 73.5% in CPVI + GP group, \( P = 0.719 \); at 2.5 years, 64.3% in CPVI group, 69.1% in CPVI + GP group, \( P = 0.605 \); at 3 years, 57.1% in CPVI group, 67.7% in CPVI + GP group, \( P = 0.009 \). There was no statistically significant difference at 3 months, 6 months, 1 year, 1.5 years, 2 years, 2.5 years, 3 years, 3.5 years, while the successful rate of operation was significant improvement in 4 years. For the patients with persistent AF, the successful rate of operation at 3 months was 89.8% in CPVI group, 88.6% in CPVI+GP group, \( P = 0.581 \); at 6 months, 61.5% in CPVI group, 88.6% in CPVI + GP group, \( P = 0.009 \); at 1 year, 56.4% in CPVI group, 82.9% in CPVI + GP group, \( P = 0.023 \); at 1.5 years, 43.6% in CPVI group, 71.4% in CPVI + GP group, \( P = 0.020 \); at 2 years, 23.1% in CPVI group, 60.0% in CPVI + GP group, \( P = 0.002 \); at 2.5 years, 15.4% in CPVI group, 60.0% in CPVI + GP group, \( P < 0.001 \); at 3 years, 10.3% in CPVI group, 57.1% in CPVI + GP group, \( P < 0.001 \); at 3.5 years, 7.7% in CPVI group, 54.3% in CPVI + GP group, \( P < 0.001 \); at 4 years, 7.7% in CPVI group, 51.4% in CPVI + GP group, \( P < 0.001 \). There was no statistically significant difference at 3 months, while the successful rate of operation was statistically significant difference at 6 months, 1 year, 1.5 years, 2 years, 2.5 years, 3 years, 3.5 years and 4 years and CPVI +GP group had significant improvement in the successful rate of operation for the patients with persistent AF. 4. the kapan Meier’ analysis of 4 years’ follow-up showed, a. for LA \( \geq 40\)mm, the successful rate of operation at 4 years was 25.4% in CPVI group, 62.7% in CPVI+GP group, \( P = 0.002 \); for LA<40mm, the successful rate of operation at 4 years’ follow-up was 33.8% in CPVI group, 53.8% in CPVI+GP group, \( P = 0.106 \). b. for the patient with LA \( \geq 40\)mm and persistent AF, the successful rate of operation at 4 years’ follow-up was 10.0% in CPVI group, 60.0% in CPVI+GP group, \( P < 0.001 \); for the patient with paroxysmal AF, the successful rate of operation at 4 years’ follow-up was 41.4% in CPVI group, 66.7% in CPVI+GP group, \( P = 0.255 \); c. for
CPVI+GP group, the successful rate of operation at 4 years’ follow-up was 62.7% in patients with LA $\geq 40$mm, 53.8% in patients with LA $< 40$mm, $P = 0.222$. In 226 patients with catheter ablation, the ablation time was $2208.3 \pm 849.2$ s in CPVI group, $3975.7 \pm 1400.0$ s in CPVI+GP group, respectively, $P < 0.001$; The X-ray exposure time was $19.9 \pm 10.2$ min in CPVI group, $32.3 \pm 13.1$ min in CPVI+GP group, respectively, $P = 0.044$, and the total operative time was $2.59 \pm 1.10$ h in CPVI group, $3.34 \pm 1.06$ h in CPVI+GP group, respectively, $P = 0.045$. No severe surgical complications were observed during and after operation in both groups.

**Conclusions** Compared with simple circumferential pulmonary vein isolation, the long-term successful rate of single time ablation in patients with paroxysmal or persistent AF can be further improved by circumferential pulmonary vein isolation plus ganglion ablation. Although additional ganglion ablation may prolong ablation time, X-ray exposure time and total operative time, it does not increase serious ablation-related complications.

**Keywords**: atrial fibrillation, pulmonary vein, ganglionated plexus, ablation, isolation