

# Clinical Application Value of Catheter Ablation Combined with Left Atrial Appendage Occlusion in Non-valvular Atrial Fibrillation

Zhang Qianrong

Liupanshui People's Hospital, Liupanshui, Guizhou, 553000, China

**Abstract:** Atrial fibrillation is a common arrhythmia with high incidence in clinic. With the rapid development of medical technology, interventional therapy for non-valvular atrial fibrillation has gradually matured and been widely used in clinic in recent years. However, the long-term effect of patients after treatment is not ideal, which leads to a greater risk of stroke and heart failure. Catheter ablation is an effective means to restore and maintain sinus rhythm in patients with atrial fibrillation, but its effect in improving stroke needs to be improved. Left atrial appendage occlusion is a minimally invasive technique in clinic, which can replace anticoagulants in the treatment of patients with non-valvular atrial fibrillation and effectively reduce the risk of stroke and bleeding. This thesis will review the development of catheter ablation combined with left atrial appendage occlusion in one-stop treatment of non-valvular atrial fibrillation.

**Keywords:** Atrial fibrillation; Radio frequency ablation; Left atrial appendage occlusion; One-stop

## 1. Introduction

There are many causes of nonvalvular atrial fibrillation, including hypertension, coronary heart disease, cardiomyopathy, chronic heart failure, etc. Patients with persistent atrial fibrillation have arrhythmia, which can lead to the risk of thromboembolism and stroke. According to clinical research, about 22% of stroke patients are caused by atrial fibrillation, which leads to an increase in mortality or serious sequelae, so we should attach great importance to clinical treatment. Scientific and effective methods are adopted to effectively control the condition of patients with nonvalvular atrial fibrillation. Interventional therapy is a common method at present, such as catheter ablation therapy, which can effectively improve the symptoms of atrial fibrillation and fully improve the physical and mental conditions of patients. However, clinical practice shows that catheter ablation therapy has a high long-term recurrence rate and has not been proved to significantly reduce the risk of embolism. Left atrial appendage occlusion is a minimally invasive interventional procedure recommended by clinic in recent years, which can prevent patients from stroke and embolism, avoid or reduce the use of anticoagulants and effectively improve the prognosis of patients.

## 2. Progress and Research Background of Radiofrequency Ablation of Atrial Fibrillation

At present, catheter ablation of atrial fibrillation is mainly based on radiofrequency energy, and radiofrequency ablation of atrial fibrillation is more and more recommended in various guidelines. The latest research has confirmed that catheter ablation is safe and effective as a treatment for atrial fibrillation, and these results provide a basis for catheter ablation to become the first-line treatment for atrial fibrillation<sup>[1-3]</sup>. Circumpulmonary vein electrical isolation (CPVI) is the cornerstone of atrial fibrillation ablation<sup>[4]</sup>. In recent years, other surgical procedures based on CPVI have been continuously explored, including combined linear ablation based on CPVI, ablation of non-pulmonary vein trigger and/or matrix mapping ablation, renal denervation, ablation of fracture potentials (CFAEs), rotor mapping ablation, and ganglion (GP) ablation. Its long-term effect needs to be further confirmed by multi-center and large sample research. With more and more extensive development of radiofrequency ablation technology in the treatment of atrial fibrillation, more surgical AIDs and technologies are also applied to radiofrequency ablation of atrial fibrillation. The appearance of pressure monitoring catheter improves the effectiveness and safety of radiofrequency ablation in the treatment of atrial fibrillation<sup>[5-6]</sup>. In recent years, catheter ablation of atrial fibrillation has achieved remarkable results in patients with heart failure. PABA-CHF experiment compared the efficacy of catheter ablation and

atrioventricular node ablation plus biventricular pacing in patients with atrial fibrillation complicated with heart failure. The results showed that catheter ablation group was superior to atrioventricular node ablation plus biventricular pacing group in left ventricular ejection fraction, 6-minute walking test and quality of life score [7]. Moreover, compared with drug therapy, the composite end point of all-cause death or hospitalization due to worsening heart failure of catheter ablation patients decreased significantly. It should be noted that the recurrence rate of atrial fibrillation and the incidence of complications are higher in patients with heart failure due to cardiac remodeling and frequent organic heart disease. Meta-analysis found that the success rate of single catheter ablation in patients with atrial fibrillation complicated with systolic dysfunction was lower than that in patients with normal systolic function, and the success rates of the two were similar after multiple ablation [8]. The traditional treatment of atrial fibrillation is surgery, and most patients undergoing heart surgery undergo atrial fibrillation ablation at the same time. This kind of surgery mainly uses radio frequency current to make local tissues expand and coagulate necrosis due to high temperature effect, which causes the reentrant ring of atrial fibrillation to be effectively blocked, thus achieving the effect of eliminating atrial fibrillation. Because the physical properties of radio frequency current are stable and have good penetration, it has high clinical application value.

### 3. Research and Background of Combined Left Atrial Appendage Occlusion

Left atrial appendage occlusion is an interventional operation. Using occluder to occlude the left atrial appendage of patients with atrial fibrillation can effectively prevent patients from developing left atrial appendage thrombosis during atrial fibrillation, and has the effect of anticoagulant therapy, avoiding patients from thromboembolism, reducing the risk of long-term disability or death, and significantly reducing the risk of bleeding. According to clinical research, left atrial appendage occlusion can significantly reduce the compliance of patients with atrial fibrillation with anticoagulation therapy, and it is often used in patients who are unwilling to undergo anticoagulation therapy for a long time or have a high risk of bleeding, which has a positive effect on the control of patients' condition [9]. According to the guideline of the European Society of Cardiology (ESC), patients with high risk of stroke but long-term oral anticoagulants are contraindicated to adopt left atrial appendage occlusion, which is mainly suitable for patients with nonvalvular atrial fibrillation. It can significantly control the condition of patients with nonvalvular atrial fibrillation whose CHA2DS2-VASc score is  $\geq 2$  or HAS-BLED score is  $\geq 3$ , and the standardized anticoagulant therapy is ineffective, and can effectively reduce the risk of stroke. Zhao Hongwei et al. used Watchman left atrial appendage occlusion for 30 patients with nonvalvular atrial fibrillation, which was effective. The risk of ischemic stroke, hemorrhagic stroke, cardiovascular events and systemic embolism was low, and the incidence of intracranial hemorrhage embolism, gastrointestinal hemorrhage and clinically related stroke was low. There was no abnormality in the follow-up results. [10-11]

### 4. The Development of One-stop Treatment for Atrial Fibrillation

One-stop treatment of atrial fibrillation is to complete catheter ablation and left atrial appendage occlusion at one time, with the purpose of preventing patients from stroke and treating patients' clinical symptoms. One-stop operation can provide patients with good combined intervention of atrial fibrillation [12]. Because atrial fibrillation can lead to a five-fold increase in the risk of stroke, according to clinical research, the risk of ischemic stroke in patients with atrial fibrillation can be significantly reduced by anticoagulant therapy, but there are some shortcomings in clinical medication, such as the narrow treatment window of vitamin K antagonists, constant dose monitoring for patients during medication, high bleeding risk for patients, and great influence of food on medication effect. Although the factor Xa inhibitor can reduce the bleeding rate of patients, it can lead to interstitial pneumonia, or renal injury and esophageal injury to varying degrees [13-14]. Catheter ablation can effectively restore the sinus rhythm of patients with atrial fibrillation, and can promote the patient's heart rhythm to maintain normal sinus rhythm. Because radiofrequency ablation of atrial fibrillation has a certain recurrence probability, radiofrequency ablation alone cannot completely improve the stroke risk of patients, so patients should be treated with other means [15]. Left atrial appendage occlusion is a treatment method that can replace anticoagulants, which can effectively prevent embolism, significantly reduce the risk of bleeding and effectively reduce the mortality of patients. Therefore, it is feasible to use catheter ablation combined with left atrial appendage occlusion for one-stop treatment of nonvalvular atrial fibrillation, which can effectively restore the sinus rhythm of patients. After treatment, patients do not need to take anticoagulants for a long time, which can significantly reduce the risk of stroke.

The feasibility of one-stop treatment was first discussed by Swaans and other medical scientists in the Netherlands, who mainly used Watchman occluder to block the left atrial appendage of patients, which would not affect the re-radiofrequency ablation. European Heart Association (ESC) guidelines for the treatment of atrial fibrillation point out that patients with nonvalvular atrial fibrillation with CHADS2 score  $\geq 2$  have a high risk of stroke, and oral anticoagulants are recommended to prevent thrombosis. However, patients may have bleeding tendency, and the effect of one-stop treatment is remarkable, which not only reduces the risk of stroke, but also improves the quality of life of patients. Although left atrial appendage occlusion can play a good role in the condition of patients with nonvalvular atrial fibrillation, patients may have related complications after operation, such as bleeding, pericardial effusion or device embolism. Relevant research shows that 10.0% of patients with nonvalvular atrial fibrillation have slight bleeding after one-stop treatment, but there is no pericardial effusion, and some patients may have inguinal hematoma [16]. In recent years, many studies have shown that one-stop treatment can lead to pericardial effusion in patients, but the incidence rate is relatively small. One-stop treatment of nonvalvular atrial fibrillation is safe, while some studies have shown that there is a slight residual leakage in postoperative follow-up, indicating that one-stop treatment is safe and has a positive effect on the treatment and prognosis of patients with nonvalvular atrial fibrillation [17].

## 5. One-stop Treatment Sequence

### 5.1 Ablation before plugging

At present, one-stop treatment of nonvalvular atrial fibrillation is usually performed in the order of ablation first and then occlusion, mainly by catheter ablation followed by sequential occlusion of the left atrial appendage. Relevant research shows that the one-stop treatment in this order has a remarkable effect, and the success rate is about ninety-seven percent. Follow-up observation shows that the occlusion effect of the patient is remarkable, and the occlusion meets the prescribed standards. The patient who stops using anticoagulants is about ninety-seven percent [18]. After treatment, patients with nonvalvular atrial fibrillation did not have thrombosis and occluder embolism. Although there is a risk of pericardial effusion, the overall incidence rate is low, indicating that the perioperative complications of patients are low and there are no obvious postoperative complications. Some research results show that about 95% of patients with nonvalvular atrial fibrillation have a significant effect of occlusion treatment, and more than 58% of patients will not have a relapse. About 78% of patients stop using anticoagulants after treatment, and about 1.7% of patients may have a stroke one year after operation [19].

In recent years, Watchman left atrial appendage occluder is commonly used to occlude patients with nonvalvular atrial fibrillation after catheter ablation, which can achieve 94% occlusion success rate, 100% occlusion success rate after 12 months of follow-up, and about 86% patients can achieve complete occlusion rate, usually the residual leakage is less than 2mm, and the risk of stroke is extremely low, with an incidence rate of only 0.5%. More than 83% patients will not have paroxysmal atrial fibrillation, and patients can do it after operation. According to relevant research, the successful blocking rate of patients with nonvalvular atrial fibrillation after one-stop treatment was about 98.9%, 3.2% patients had severe bleeding, and only one patient had mild ischemic stroke. Thrombolytic therapy was performed for the patient, but the patient died of intracranial hemorrhage. One patient had pericardial effusion 30 days after operation, and his condition improved after drainage treatment, which did not have a great impact on the quality of life of the patient. Therefore, this sequential one-stop treatment can reduce the risk of stroke and bleeding and have a good prognosis, but we should pay close attention to the recurrence of the patient's disease and give symptomatic intervention at an early stage [20]. According to the related research, the patients with nonvalvular atrial fibrillation were treated with cryoballoon ablation first, and then left atrial appendage occlusion was performed. Both Watchman and ACP occluders can occlude the patients. After the operation, 72% of the patients' heart rhythm changed to sinus rhythm, 86% of the patients' left atrial appendage was successfully occluded, and 14.3% of the patients had residual leakage, which was less than 5 mm. After one year of follow-up, the residual leakage of the patients was obviously improved, and no embolism or device related was found. It shows that the treatment of left atrial appendage occlusion after cryoballoon ablation has a significant effect on patients with contraindications of antithrombotic drugs, and is suitable for patients with high risk of stroke, and the safety of treatment operation is high [21].

## 5.2 Blocking before ablation

One-stop treatment of nonvalvular atrial fibrillation started in 2015. Heeger and other medical scientists used Watchman occluder to treat patients with left atrial appendage occlusion. The success rate of surgical treatment was 100.0%, and the operation was feasible. No perioperative complications occurred in patients. Follow-up after the operation showed that there was no residual leakage, no occluder falling off, no stroke, bleeding and other problems. Some research results showed that about 63% of patients with nonvalvular atrial fibrillation had sinus rhythm conversion, and the effect of different occluders was remarkable, which did not affect the catheter ablation after the patient [22]. Some research results show that blocking first and then ablation can obviously control the condition of patients with persistent nonvalvular atrial fibrillation. This sequence of one-stop treatment is highly feasible, and 52% of patients have no recurrence of atrial fibrillation and tachycardia after operation, which can effectively prevent patients from tachycardia after operation. The patients with nonvalvular atrial fibrillation were significantly improved by blocking first and then ablation, and more patients did not need anticoagulant therapy after operation. It shows that the risk of one-stop treatment for patients with nonvalvular atrial fibrillation is small, the safety of treatment operation is high, and the effect and success rate of catheter ablation can be improved.

Blocking before ablation has obvious advantages in the treatment of patients with nonvalvular atrial fibrillation. This treatment method can significantly reduce the incidence of residual leakage of patients' equipment, effectively reduce the risk of esophageal injury, and prevent esophageal ultrasound from damaging the patient's body after ablation. It is feasible to use LAAC delivery sheath for surgical treatment, which can make the subsequent ablation treatment more convenient, make the circular positioning catheter smoothly introduced, and effectively reduce the cost of long-supported cannula. Closure before ablation can significantly reduce the risk of iatrogenic atrial septal defect in patients with nonvalvular atrial fibrillation, and can effectively improve the success rate of ablation treatment. Relevant studies show that the success rate of closure before ablation is about 92.3%, and no residual leakage exceeding 5mm is found in patients after follow-up. The recurrence rate of postoperative atrial fibrillation is low, and more than 70% of patients have no recurrence, indicating that this treatment method has high application value [23].

## 6. Conclusion

The disability rate and mortality rate of nonvalvular atrial fibrillation are high, and the patients are at high risk of cardiovascular and cerebrovascular events, which is extremely harmful to the life safety of the public. Therefore, clinical treatment pays great attention to the relief and control of patients' symptoms, especially the prevention of patients' stroke to avoid cardiovascular and cerebrovascular events. Catheter ablation combined with one-stop treatment of left atrial appendage occlusion plays a significant role in the treatment of patients with nonvalvular atrial fibrillation. This method belongs to comprehensive treatment, with high safety and feasibility in clinical operation. During treatment, appropriate ablation energy should be selected according to the patient's condition, and the left atrial appendage occlusion device should be used to promote the patient's condition to be effectively treated. In the future, the one-stop treatment sequence should be further studied, with a view to formulating a suitable treatment plan for each patient, maximizing the treatment success rate and reducing the risk of complications.

## Acknowledgement

Fund project: Presided over the project of Guizhou Provincial Health Commission: "Clinical Application Value of Bioabsorbable Stent in Percutaneous Coronary Intervention in the Treatment of Non-left Main Lesions."

## References

- [1] Wazni OM, Marrouche N F, Martin DO, et al (2012). Radiofrequency Ablation vs Antiarrhythmic Drugs as First-line Treatment of Symptomatic Atrial Fibrillation: A Randomized Trial [J]. *Jama the Journal of the American Medical Association*, vol. 9, no. 21, pp. 1580-1580.
- [2] Jens Cosedis Nielsen, Arne Johannessen, Pekka Raatikainen, Et al. (2012) Radio frequency ablation as initial therapy in paroxysmal fibrosis [J]. *New England Journal of Medicine*, vol. 367, no. 17, pp.

1587-1595.

[3] Antti H, Fausto B, Cosedis N J, et al (2015). Radiofrequency ablation vs. Antiarrhythmic drug therapy as first line treatment of symptomatic atrial fibrillation: systematic review and meta-analysis [J]. *Europace: European pacing, arrhythmias, and cardiac electrophysiology: journal of the working groups on cardiac pacing, arrhythmias, and cardiac cellular electrophysiology of the European Society of Cardiology*, vol. 17, no. 3, pp. 370-378.

[4] Haïssaguerre M, Jais P, Shah DC, et al(1998). Spontaneous initiation of atrial fibrillation by ectopic beats originating in the pulmonary veins, *N Engl J Med*, vol. 339, no. 10, pp. 659-666.

[5] Andrade J G, Monir G , Pollak S J, et al. (2014) Pulmonary vein isolation using “contact force” ablation: The effect on dormant conduction and long-term freedom from recurrent atrial fibrillation — A prospective study [J]. *Heart Rhythm*, vol. 11, no. 11, pp. 1919-1924.

[6] Shurrab M , Biase L D , Briceno D F , et al(2015). Impact of Contact Force Technology on Atrial Fibrillation Ablation: A Meta-Analysis. [J]. *Journal of the American Heart Association*, vol. 31, no. 9, p. 222.

[7] Khan MN, Jais P, Cummings J, et al(2008). Pulmonary-vein isolation for atrial fibrillation in patients with heart failure. [J]. *The New England journal of medicine*, vol. 359, no. 17, pp. 1778-1785.

[8] Huang Congxin, Zhang Shu, Huang Dejia, et al(2018). Atrial fibrillation: current understanding and treatment suggestions -2018 [J]. *China Journal of Cardiac Pacing and Electrophysiology*, vol. 32, no. 4, pp. 315-368.

[9] Jing Weilin(2022). Effects of left atrial appendage occlusion and radiofrequency ablation on the quality of life of patients with atrial fibrillation at different ages [D]. Hebei Medical University.

[10] Zhao Hongwei, Yin Xiaomeng, Wang Chengfu, et al(2019). Effect of Watchman left atrial appendage occlusion and oral rivaroxaban on stroke prevention in patients with nonvalvular atrial fibrillation [J]. *Heart Journal*, vol. 31, no. 06, pp. 673-676.

[11] Li Yuanzhi, Li Yidan, Sun Lanlan, etc(2022). Left atrial strain for predicting recurrence in patients with non-valvular atrial fibrillation after catheter ablation: a single-center two-dimensional speckle tracking retrospective study [J]. *BMC Cardiovascular Disorders*, vol. 22 no. 1, p. 468.

[12] Cai Wenzhi, Sun Mingyu, Wang Zulu, et al(2022). Analysis of therapeutic effect and recurrence factors of young patients with nonvalvular atrial fibrillation after different catheter ablation [J]. *Journal of Clinical Military Medicine*, vol. 50, no. 10, pp. 1010-1014.

[13] Nezu Mari, Ueda Shinichiro, Uchida Kazutaka, etc(2022). Association between body mass index and long-term clinical outcomes in patients with non-valvular atrial fibrillation taking oral anticoagulants. [J]. *Heart and Vessels*, vol. 10, no. 7, pp. 380-383.

[14] Zhao Yao, Zhao Teng, Zhao Haijuan, et al(2022). Application progress of catheter ablation combined with left atrial appendage occlusion in patients with atrial fibrillation [J]. *Journal of Naval Medical University*, vol. 43, no. 8, pp. 936-942.

[15] Wang Qunshan, Chen Mu, Sun Jian politician, et al(2020). Feasibility and perioperative safety analysis of catheter ablation of atrial fibrillation combined with left atrial appendage occlusion [J]. *Chinese Journal of Cardiology*, vol. 48, no. 10, pp. 842-847.

[16] Ye Cong, Han Xuesong, Chen Yiming, etc (2022). Stroke prevention of thoracoscopic left atrial appendage clipping in patients with non-valvular atrial fibrillation at high risk of stroke and bleeding: study protocol for a non-randomised controlled clinical trial. [J]. *BMJ open*, vol. 12, no. 10, p. 63931.

[17] Song Qunxia, Wang Lihong(2021). Analysis of influencing factors of new complications after catheter ablation combined with left atrial appendage occlusion [J]. *Journal of Medical Imaging*, vol. 31, no. 02, pp. 207-211.

[18] Martsevich Sergey Yu., Lukina Yulia V., Kutishenko Natalia P., etc(2022). Analysis of Adverse Events in the Treatment of Patients with Non-Valvular Atrial Fibrillation with Oral Anticoagulants: Data from the “ANTEY” Observational Study [J]. *Pharmaceuticals*, vol. 15, no. 10, pp. 1209-1213.

[19] Dong Yan, Ren Jilai, Wang Xuecheng, et al(2021). Follow-up results of radiofrequency catheter ablation combined with left atrial appendage occlusion for nonvalvular atrial fibrillation [J]. *Chinese Journal of Cardiac Arrhythmias*, vol. 25, no. 6, pp. 504-509.

[20] Xing Yu, Li Yinjun (2019). Comparative study on the efficacy and safety of rivaroxaban, dabigatran etexilate and warfarin in anticoagulant therapy for elderly patients with nonvalvular atrial fibrillation [J]. *Journal of Cardiovascular and Cerebrovascular Diseases of Integrated Traditional Chinese and Western Medicine*, vol. 17, no. 03, pp. 411-413.

[21] Zeng Wanli, Huang Jijiang, Chu Wei (2017). Study on the application value of irrigation radiofrequency ablation in the surgical treatment of mitral valve disease complicated with atrial fibrillation [J]. *China University Doctor*, vol. 31, no. 03, pp. 209+211.

[22] Wang Yunlu (2021). Study on one-stop treatment of persistent atrial fibrillation by radiofrequency ablation and left atrial appendage occlusion combined with radiofrequency ablation [D]. North Sichuan Medical College.

[23] He Bin, Du Xianfeng, Liu Jing, et al (2017). Safety and effectiveness analysis of “one-stop” interventional therapy for nonvalvular atrial fibrillation [J]. *Chinese Journal of Cardiac Arrhythmias*, vol. 21, no. 3, pp. 197-202.