Radiofrequency Ablation for Atrial Fibrillation

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Abstract

There have been a lot of progression in the treatment of atrial fibrillation during the last 10 years. Atrial fibrillation treatment is not only focus on prevention of thromboembolic comlications of this tachyarrhythmia but also on heart rate control which can be obtained in many ways. Recently, more information of atrial fibrillation mechanism led to new treatment modalities including surgery and the use of radiofrequency ablation. However, most of these new treatment forms are still investigational, evolving and reserved to atrial fibrillation patients who are refractory to standard treatment.

Key word : Atrial Fibrillation, Radiofrequency Ablation

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A lot of information has been obtained regarding atrial fibrillation (AF) during the past 10 years. The thromboembolic events related to AF have been well defined(1). The morbidity and mortality associated with this arrhythmia has had significant impact on health care since AF is the most common sustained cardiac arrhythmia(2,3). Although AF has known to cardiologists for years, the mechanism, classification and treatment of this arrhythmia has not been settled. Two main strategies are proposed in the management of AF, one is ventricular rate control with anticoagulation and the other is to maintain normal sinus rhythm (the rhythm control strategy). Studies to define the appropriate way of treating AF are on going(4-6). The preliminary result of the atrial fibrillation follow-up investigation of rhythm management (AFFIRM) trial supported the ventricular rate control with anticoagulation strategy and showed that current antiarrhythmic medication are far from perfect in maintaining normal sinus rhythm(6).

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The ventricular rate control in AF could be achieved with medications, Atrioventricular (AV) nodal modification with radiofrequency catheter ablation or AV nodal ablation with implantation of a permanent pacemaker[7-13]. This treatment strategy would require anticoagulation since the patients are still in AF and have thromboembolic risk. Antiarrhymic medications would be the first choice in practice [8]. AV nodal modification or AV nodal ablation with permanent pacemaker would be preserved in drugs intolerant or refractory patients. For AV nodal modification, the target would be the tissue around the AV node starting at the posteroseptal area (slow AV nodal pathway) to modify the AV nodal conduction and eliminate posterior atrial inputs to the AV node[9,10]. The endpoint would be the ventricular response with and without intraveneous isopretelenol infusion. The AV nodal modification offers the benefit of controlling ventricular response in AF without antiarrhythmic medications. However, main problems of this procedure are the inadvertent complete AV block in 5-10 per cent and the relatively high risk of increasing ventricular rate after ablation. Studies have demonstrated improved symptom relief with AV nodal ablation over AV nodal modification[11,12]. Thus AV nodal modification without pacemaker implantation is only rarely used for patients with rapid ventricular response during AF. For AV nodal ablation, the procedure is easier to perform with high efficacy. The procedure provided highly effective means of controlling the ventricular rate and significantly improved symptoms and quality of life for highly symptomatic AF that was refractory to medical treatment[13]. The down side is lifelong pacemaker dependency, loss of AV synchrony and the persistent need for anticoagulation. There is also the possible small risk of sudden death after AV nodal ablation which is most likely due to ventricular tachyarrhythmia. The future development in AV nodal modification to improve the efficacy and avoiding the need for a permanent pacemaker would be interesting.

In the rhythm control strategy, antiarrhythmic medications with direct current cardioversion have been in practice for years. However, the unsatisfactory long-term efficacy and proarrhythmic risks of antiarrhythmic drugs have led to the development of new treatment modalities for AF. With more understanding in AF mechanism, the microreentry theory led to the idea of creating barriers, reducing the atrial tissue prohibiting the wavelet to perpetuate and the arrhythmia to sustain. On the basis of this hypothesis, surgery with the Maze procedure (with subsequent modified versions) reported promising results. However the complexity and the need for open heart surgery are the limitations of this treatment modality [14,15]. The microreentry theory and the results of the Maze procedure subsequently led to the attemp to create linear lesions in atria with radiofrequency catheter ablation targeting on "the maintaining substrate"[16-18]. Studies showed that linear ablation for AF is possible but is far from being standard clinical practice. The technique to create a line from dots of ablation is very difficult. Better equipment and technique are needed to minimize the procedure time, increase the success rate and decrease complications. Recently, the discovery of the trigger foci that can initiate AF has shifted the interest in treating this tachyarrhyhthmia. The trigger foci which were mainly at the pulmonary veins, have been identified and targeted with radiofrequency ablation[19-22]. The early phase of this procedure was to target the abnormal atrial activity that initiated AF[19,20]. With more information that the trigger foci may be multiple, not found at the first procedure and the complication of pulmonary vein stenosis led to the modificadtion of the procedure, the pulmonary vein (PV) isolation[21-23]. The concept is to isolate the trigger foci in the pulmonary veins from the left atrium and preventing the electrical activity from the abnormal foci entering the left atrium and initiate AF. Studies[19-23] have shown promising results of pulmonary vein isolation in AF with varieties in equipment, technique, efficacy and safety among institutes. The possible complications of AF ablation systemic embolism, pulmonary vein stenosis, cardiac tamponade and phrenic nerve paralysis. There are also non pulmonary vein trigger foci which may account for 15 per cent in some studies [24]. The report by Raungratanaamporn O in this issue represented the earliest experience of PV ablation in Thailand, demonstrating the feasibility and short-term result of PV ablation for medical refractory paroxysmal fibrillation. However, with the small number of patients, l long procedure time and short-term follow-up, these factors still humble the electrophysiologists to offer this treatment modality to the patients.

At present, the issue of catheter ablation for AF is rapidly evolving and far from settled. However some conclusions could be made. The triggering foci for AF initiation and microreentry hypothesis for AF maintaining have been supported with ablation therapy. The radiofrequency (RF) ablation for AF, whichever

technique, is not benign with current technology. The linear ablation procedure is very difficult with the present equipment and awaits major improvement. The pulmonary vein isolation is not the first line treatment in AF patients but may be considered in a highly symptomatic and drugs refractory situation with well balanced risk-to-benefit profile for each individual has to be carefully evaluated before proceeding with the procedure. The future of AF ablation would depend on the understanding of the mechanism and nature of the disease which will help to classify this tachyarrhythmia and define the most appropriate patients for each treatment modality. The development in the ablation technology to simplify the procedure and increase safety and efficacy is crucial in order to broaden the utilization of this treatment form.

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REFERENCES

1. Hart RG, Halperin JL. Atrial fibrillation and thromboembolism: A decade of progress in stroke prevention. Ann Intern Med 1999; 131: 688-95.
2. Go AS, Hylek EM, Borowsky LH, Phillips KA, Selby JV, Singer DE. Prevalence of diagnosed atrial fibrillation in adults: National implications for rhythm management and stroke prevention: The An Ticoagulation and Risk Factors in Atrial Fibrillation (ATRIA) Study. JAMA 2001; 285: 2370-5.
3. Levy S, Maarek M, Coumel P, et al. Characterization of different subsets of atrial fibrillation in general practice in France:Tthe ALFA study. Circulation 1999; 99: 3028-35.
4. Hohnloser SH, Kuck KH, Lilienthal J. Rhythm or rate control in atrial fibrillation: Pharmacological Intervention in Atrial Fibrillation (PIAF): A randomised trial. Lancer 2000; 356: 1789-94.
5. Sopher SM, Camm AJ. New trials in atrial fibrillation. J Cardiovasc Electrophysiol 1998; 9: S211-S215.
6. The Planning and Steering Committees of the AFFIRM study for the NHLBI AFFIRM investigators. Atrial fibrillation follow-up investigation of rhythm management the AFFIRM study design. Am J Cardiol 1997; 79: 1198-202.
7. Rawles JM. What is meant by a "controlled" ventricular rate in atrial fibrillation" Br Heart J 1990; 63: 157-61.
8. Segal JB, MeNamara RL, Miller MR. The evidence regarding the drugs used for ventricular rate control. J Fam Pract 2000; 49: 47-59.3
9. Williamson BD, Man KC, Daoud E, Nicbaner M, Strickberger SA, Morady F. Radiofrequency catheter modification of atrioventricular conduction to control the ventricular rate during atrial fibrillation. N Engl J Med 1994; 331: 910-7.
10. Feld GK, Fleck RP, Fujimura O, Prothro DL, Bahnson TD, Ibarra M. Control of rapid ventricular response by radiofrequency catheter modification of the atrioventricular node in patients with medically refractory atrial fibrillation. Circulation 1994; 90: 2299-307.
11. Kay GN, Ellenbogen KA, Giudici M, et al. The Ablate and Pace Trial: A prospective study of catheter ablation of the AV conduction system and permanent pacemaker implantation for treatment of atrial fibrillation. J Interv Card Electrophysiol 1998; 2: 121-35.
12. Wood MA, Brown-Mahoney C, Kay GN, Ellenbogen KA. Clinical outcomes after ablation and pacing therapy for atrial fibrillation: A palpitations and quality-of-life evaluation in patients with proven isthmus block. Circulation 1999; 99: 534-40.
13. Natale A, Zimerman L, Tomassoni G, et al. AV node ablation and pacemaker implantation after withdrawal of effective rate-control medications for chronic atrial fibrillation: Effect on quality of life and exercise performance. Pacing Clin Electrophysiol 1999; 22: 1634-9.
14. Cox JL, Boineau JP, Schuessler RB, Jaquiss RD, Lappas DG. Modification of the maze procedure for atrial flutter and atrial fibrillation, I: Rationale and surgical results. J Thorac Cardiovasc Surg 1995; 110: 473-84.
15. Cox JL, Jaquiss RD, Schuessler RB, Boineau JP. Modification of the maze procedure for atrial flutter and atrial fibrillation. II: Surgical technique of the maze III procedure. J Thorac Cardiovasc Surg 1995; 110: 485-95.
16. Swartz JF, Pellersels G, Silvers J, et al. A catheter-based curative approach to atrial Fibrillation in humans. Circulation 1994; 90: I-335.
17. Haissaguerre M, Jais P, Shah D, et al. Right and left atrial radiofrequency catheter therapy of paroxysmal atrial fibrillation. J Cardiovasc Electrophysiol 1996; 7: 1132-44.

18. Jais P, Shah DC, Takahashi A, Hocini M, Haissaguerre M, Clementy J. Long-term follow-up after right atrial radiofrequency catheter treatment of paroxysmal atrial fibrillation. Pacing Clin Electrophysiol 1998;21:2533-8.
19. Jais P, Haissaguerre M, Shah DC, Chouairi S, Gencel L, Hocini M, et al. A focal source of atrial fibrillation treated by discrete radiofrequency ablation. Circulation 1997; 95:572-6.
20. Haissaguerre M, Jais P, Shah DC, et al. Catheter ablation of chronic atrial fibrillation targeting the reinitiating triggers. J Cardiovasc Electrophysiol 2000;11:2-10.
21. Haissaguerre M, Jais P, Shah DC, et al. Electrophysiological end point for catheter ablation of atrial fibrillation initiated from multiple pulmonary venous foci. Circulation 2000;101:1409-17.
22. Pappone C, Oreto G, Rosanio S, et al. Atrial electroanatomic remodeling after circumferential radiofrequency pulmonary vein ablation. Efficacy of an anatomic approach in large cohort of patients with atrial fibrillation. Circulation 2001;104:2539-44
23. Oral H, Knight BP, Tada H, et al. Pulmonary vein isolation for paroxysmal and persistent atrial fibrillation. Circulation 2002; 105:1077-81.
24. Kok LC, Mangrum M, Haines DE, Mounsey P. Cerebrovascular complications associated with pulmonary vein ablation. J Cardiovascular Electrophysiol 2002;13:764-7.2

การรักษา Atrial Fibrillation ด้วยการจี้ไฟฟ้าคลื่นความถี่สูง

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มีการพัฒนาการรักษา Atrial fibrillation อย่างมากในระยะ 10 ปีที่ผ่านมา โดยการรักษานอกจากการป้องกันผลแทรกซ้อนของ Atrial Fibrillation ในการเกิด thromboembolism แล้ว อาจจะแบ่งเป็นการควบคุมอัตราการการเต้นของหัวใจห้องล่าง โดยปล่อยให้หัวใจห้องบนเป็น Atrial fibrillation หรือการพยายามทำให้หัวใจกลับมาเต้นเป็นปกติ โดยไม่ปล่อยให้ห้องบนเป็น Atrial fibrillation โดยปกติแล้วไม่ว่าจะเป็นการควบคุมอัตราการเต้นของช่องล่างอย่างเดียว หรือการพยายามทำให้หัวใจเต้นปกติ การรักษาด้วยยาจะเป็นการรักษาลำดับแรก อย่างไรก็ตามมีการพัฒนาการรักษา Atrial fibrillation ด้วยการจี้หัวใจด้วยไฟฟ้าความถี่สูง โดยอาจจะจี้รักษาบริเวณ AV junction ในกรณีที่จะควบคุมอัตราการเต้นของช่องล่างแต่เพียงอย่างเดียว ซึ่งอาจจำเป็นต้องใช้เครื่องกระตุ้นหัวใจด้วยไฟฟ้าชนิดถาวรเป็นการควบคู่ไป ส่วนการรักษา Atrial fibrillation ให้หายขาดด้วยการจี้ไฟฟ้าคลื่นความถี่สูง มีการพัฒนารูปแบบการรักษา เครื่องมือที่ใช้ วิธีการใหม่ ๆ มาโดยตลอด โดยได้ผลดีขึ้นตามลำดับ อย่างไรก็ตามการรักษา Atrial fibrillation ด้วยยายังคงเป็นขั้นตอนแรก ส่วนการจี้ไฟฟ้าคลื่นความถี่สูง จะจำเป็นในผู้ป่วยที่ไม่ได้ผลจากการใช้ยา ในอนาคตการรักษา Atrial fibrillation ด้วยการจี้ไฟฟ้าความถี่สูง อาจจะมีบทบาทมากขึ้น ถ้าหัตถการมีผลสำเร็จและความปลอดภัยที่สูงพอ

คำสำคัญ : ภาวะหัวใจช่องบนเต้นพลิ้ว, การจี้หัวใจด้วยไฟฟ้าความถี่สูง

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