Segmental radiofrequency ablation of pulmonary vein ostia for patients with refractory paroxysmal atrial fibrillation using multi-slice spiral computed tomography guidance

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Abstract: Objective: To evaluate the safety and clinical efficacy of segmental radiofrequency ablation of pulmonary vein (PV) ostia for patients with refractory paroxysmal atrial fibrillation (AF) under multi-slice spiral computed tomography (MSCT) guidance before the procedure. Methods: A series of 58 consecutive patients with refractory paroxysmal AF were enrolled to undergo segmental radiofrequency ablation of PV ostia using a PV circular mapping catheter manipulated several times to ensure complete isolation between PVs and left atrium (LA). Before ablation, patients received MSCT to generate 3-dimensional images of the left atrium and proximal PVs. Patients then underwent segmental radiofrequency ablation of PV ostia using PV circular mapping catheter manipulated several times to ensure complete isolation between PVs and LA. Results: No complications occurred during the procedure. One patient developed delayed cardiac tamponade, which was drained percutaneously. The mean follow-up time was (17.1±9.3) months. Forty-one patients (95%) experienced improved quality of life one month after the procedure. Thirty-six patients (83%) showed stable sinus rhythm, while 10 patients (23%) required additional anti-arrhythmic drugs. AF returned in 6 (14%) patients who underwent anti-arrhythmic drug therapy, but the number of episodes was less than that before the procedure. However, one patient experienced recurrent episodes of atrial flutter. Conclusion: It is safe and effective to perform segmental radiofrequency ablation of PV ostia for patients with refractory paroxysmal AF using MSCT guidance mapping.

Key words: Atrial fibrillation, Pulmonary vein, Radiofrequency ablation, Multi-slice spiral computed tomography

INTRODUCTION

Pulmonary veins (PV) may play an important role in both the initiation and maintenance of paroxysmal atrial fibrillation (AF) (Fynn and Kalman, 2004). Curative treatment of patients with paroxysmal AF is possible by radiofrequency ablation, making segmental or linear lesions around the ostia of PVs using a 3-dimensional mapping system (Carto) (Pappone et al., 2000; 2001; Oral et al., 2003). Multi-slice spiral computed tomography (MSCT) could generate a 3-dimensional image of left atrium (LA) and proximal PVs (Wood et al., 2004; Jongbloed et al., 2005). The aim of this study was to evaluate the safety and clinical efficacy of segmental radiofrequency ablation of PV ostia for patients with refractory paroxysmal AF using MSCT guidance before the procedure.

MATERIALS AND METHODS

Selection of patients

Inclusion criteria: (1) age ≥30 years, but ≤80 years; (2) refractory or drug-intolerant paroxysmal
AF; (3) minimum of one episode per month; (4) no obvious organic heart disease; (5) written informed consent. Exclusion criteria: (1) obvious organic heart disease or hyperthyroidism; (2) incessant AF; (3) thrombosis in LA; (4) severe systemic disease, including but not limited to: malignancy, renal failure (serum creatinine > 25 mg/L); (5) pregnancy; (6) hypersensitive to contrast; (7) refusal to undergo or intolerance to, the ablation procedure. On the basis of the above criteria, 58 patients with refractory paroxysmal AF were enrolled to undergo segmental radiofrequency ablation of PV ostia between October 2002 and November 2004 in Sir Run Run Shaw Hospital. There were 36 men and 22 women with mean age of (57.4±9.5) (32~79) years. Except for 30 patients with hypertension, no organic heart disease was found. Their average history of AF was (5.5±5.1) (1.1~20.0) years. The episode was more than once every month. They were either intolerant of or resistant to, multiple anti-arrhythmic drugs.

**Procedure approach**

The patients underwent 16 detector row spiral CT (computed tomography) scannings on regular sinus rhythm to reconstruct a 3-dimensional structure of LA and all proximal PVs before the ablation procedure. Ostia were measured in one direction (superior-inferior) with MSCT (Figs.1, 2 and 3). Pre-procedure patient preparation and mapping protocol is described in Yang et al. (2003). Left atrial catheterization was done by a trans-septal route with a standard Brockenbrough needle and a long sheath. Under the guidance of ablation catheter, the long sheath was inserted into the PV. PV mapping and ablation was done according to following protocol: left superior→left inferior→right superior→right inferior. The size of the circular mapping catheter was chosen according to the measurement of PV diameter by MSCT and retrograde PV angiogram. The circular mapping catheter was placed exactly at the ostium of the PV. A standard or an irrigated-tip ablation catheter was used. The ablation target was the junction of PV and LA. Radiofrequency energy was applied in temperature-controlled mode, with a power limit of 40 W, a target temperature of 50 °C for the standard catheter and 45 °C for the irrigated-tip ablation catheter. PV potential disappearance after thirty-second ablation was considered effective, and further ablation was delivered at the same focus for 90~120 s. The PV circular mapping catheter was manipulated several times to ensure there was complete isolation between the PVs and the LA. Successful PV isolation was defined according to the following criteria: PV