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Left atrial catheter ablation subsequent to Watchman® left atrial appendage device implantation: a single centre experience

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Aims Left atrial appendage device occlusion is an increasingly accepted therapy for stroke prevention in atrial fibrillation. The feasibility and safety of left atrial catheter ablation procedures in the presence of a left atrial appendage device implant is unclear. We report on 10 cases of successful left atrial catheter ablation therapy for atrial fibrillation in patients with an implanted Watchman® device.

Methods and results Consecutive patients with an existing Watchman® left atrial appendage implant and symptomatic antiarrhythmic-drug refractory atrial fibrillation or atrial tachycardias requiring left atrial catheter ablation therapy were included. Open irrigated tip ablation and circular mapping catheters were positioned in the left atrium via double transseptal access. Ten patients underwent successful left atrial geometry creation and complex atrial arrhythmia mapping and ablation in the presence of a chronically implanted Watchman® device. Arrhythmia targets included left atrial flutters, a focal tachycardia, left atrial CFAE zones, and pulmonary vein electrical isolation. The appearances of the Watchman® device position and device integrity were confirmed to be satisfactory in all patients at the end of the procedure based on fluoroscopy and intracardiac echocardiography imaging. There were no procedural complications.

Conclusion Left atrial catheter ablation therapy in the presence of an implanted Watchman® left atrial appendage occlusion device was efficacious and uncomplicated in our small single centre experience.

Keywords Left atrial ablation • Occlusion device • Watchman • Left atrial appendage

Introduction

Left atrial appendage (LAA) device occlusion is an increasingly accepted therapy for stroke prevention in atrial fibrillation (AF).[1–4] Catheter ablation therapy for atrial fibrillation provides efficacious rhythm control for patients with symptomatic, drug refractory AF[5–7] but does not have a proven role in stroke prevention. Patients with a chronically implanted LAA occlusion device might require catheter mapping and ablation techniques for rhythm control. The feasibility and safety of left atrial (LA) catheter ablation procedures in the presence of an LAA device implant is unclear. We report on 10 cases of successful LA catheter ablation therapy for AF in patients with an implanted Watchman® device.

Methods

Consecutive patients with an existing Watchman® LAA implant and symptomatic antiarrhythmic-drug refractory AF or atrial tachycardias requiring left atrial catheter ablation therapy were included. This study was approved by the institutional review board for human research and complies with the Declaration of Helsinki. Informed consent was obtained from all study participants.

Procedural planning

Patients underwent screening transoesophageal echocardiography (TOE) and a contrast 64-slice cardiac computed tomography (CT) scan prior to the planned procedure (*Figure 1*). Three-dimensional

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What's new?

- This is the first reported patient series of left atrial catheter ablation in the presence of a chronically implanted Watchman® left atrial appendage occlusion device.
- Complex left atrial tachyarrhythmia mapping was able to be performed using a circular mapping catheter in the presence of a Watchman® implant without complication.

reconstruction of the LA and pulmonary veins and was performed from the CT scan using Ensite Verismo software (St Jude Medical, St Paul, MN, USA).

Procedure

Antiarrhythmic drug therapy was ceased 3 days prior. Therapeutic warfarin therapy was continued uninterrupted. Procedures were performed under general anaesthesia using a bifemoral venous approach. Intracardiac echocardiography was utilized to guide double transseptal puncture and during LA electro-anatomic 3D mapping. IV heparin was administered prior to the first transseptal puncture with a target ACT of $\geq$350 s.[8] An oesophageal thermistor probe was positioned for monitoring of oesophageal temperatures.

Ensite NavX 3D cardiac navigational system (St Jude Medical, St Paul, MN, USA) with image integration of the segmented cardiac CT scan was utilized. A decapolar diagnostic catheter was positioned in the coronary sinus. A 20 mm decapolar circular mapping catheter and an irrigated tip ablation catheter were utilized for mapping and radiofrequency ablation. Left atrial complex fragmented atrial electrogram (CFAE) mapping was performed for patients presenting in AF. Left atrial 3D—activation mapping was performed for patients presenting in or developing sustained organized atrial tachycardia.

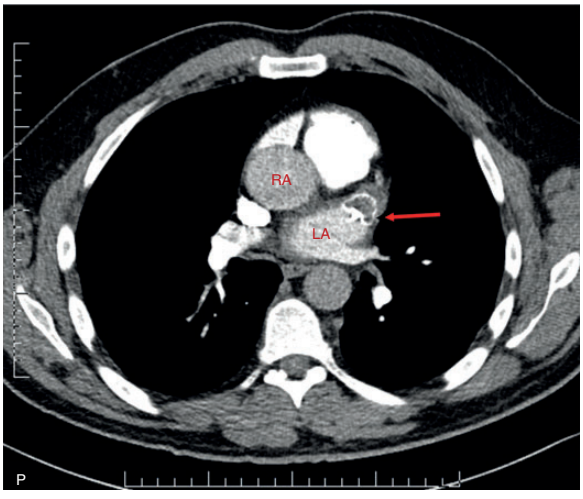

Figure 1 Transverse CT scan slice through the thorax showing complete exclusion of the distal left atrial appendage with a Watchman® device (arrowed) 6 months after implant. RA, right atrium; LA, left atrium.

Left- and right-sided pulmonary vein mapping was performed in all patients with additional ablation performed to achieve an endpoint of complete pulmonary vein entrance and exit conduction block. Additional CFAE-guided or linear left or right atrial ablation was individualized according to requirements for persistent forms of AF. Patients undergoing ablation for persistent AF were cardioverted back to sinus rhythm following CFAE-guided ablation with pulmonary vein gap mapping and linear ablation performed in sinus rhythm.

Post-procedure IV heparin was reversed with Protamine and oral anticoagulation commenced 4 h post-procedure (in the case of Dabigatran or Rivaroxaban). Antiarrhythmic drug therapy was recommenced. Patients were observed overnight in a Coronary Care Unit and generally discharged within 24 h of the procedure.

Patient follow-up

Persistent early tachyarrhythmias lasting $\geq$48 h were treated with electrical cardioversion. Clinical follow-up for arrhythmia recurrence was performed at 3, 6, and 12 months guided by patient symptom reporting, 12-lead ECG and implanted cardiac rhythm device interrogation where applicable. Holter monitoring was performed at 12 months or as required to assess symptom recurrence. Antiarrhythmic drug therapy was ceased at or after 3 months according to physician and patient discretion. Oral anticoagulant therapy was discontinued at 3 months and replaced with Aspirin 100 mg daily unless repeated electrical cardioversions were required.

Results

Patient demographics

Ten patients with a previously implanted Watchman® LAA occlusion device underwent LA catheter ablation therapy between February 2012 and March 2014. Eight males and two females were included with a mean age of 63 $\pm$ 5 years (range 56–73). The group included six patients with a history of paroxysmal, two with persistent, and two with longstanding persistent forms of AF. Five patients had an implanted cardiac rhythm device (four pacemakers, one cardiac defibrillator). All patients had previously undergone a combined pulmonary vein electrical isolation and Watchman® device implant procedure. Following commercial availability and Therapeutic Goods Administration approval of the Watchman® left atrial appendage occlusion device in Australia in December 2009, patients with a $CHADS_2$ score of 1 or greater seeking to undergo left atrial catheter ablation for symptomatic, drug refractory non-valvular AF at our centre were offered concomitant implant as an alternative to long-term oral anticoagulation. Three patients had a prior history of stroke or systemic embolism, one patient had a contraindication to long-term anticoagulation due to cirrhosis of the liver and documented oesophageal varices and three patients had relative contraindications due to the requirement for concomitant antiplatelet therapy for prior drug-eluting coronary stents. Three patients with CHA_2DS_2VASc score of 2 or more had undergone Watchman® implantation as their chosen alternative to indefinite oral anticoagulation. The mean $CHADS_2$ score for the group was 1.8 $\pm$ 0.9 (range 1–3) and mean CHA_2DS_2VASc score was 2.4 $\pm$ 0.9 (range 1–4) (*Table 1*).

Table 1 Demographic and clinical variables for patient group

	n = 10
Age (years)	63 (±5)
Females (*n*)	2 (20%)
Paroxysmal AF (*n*)	6 (60%)
Duration of AF (years)	8 (±6)
Time since implant (days)	375 (±290)
Diabetes (*n*)	2 (20%)
Hypertension (*n*)	7 (70%)
IHD (*n*)	3 (30%)
CHF (*n*)	2 (20%)
CVA (*n*)	3 (33%)
CHA_2DS_2VASc (*n*)	2.4 (±0.9)
EF (%)	60 (±6)

AF, atrial fibrillation; IHD, ischaemic heart disease; CHF, congestive heart failure; CVA, prior stroke; EF, ejection fraction.

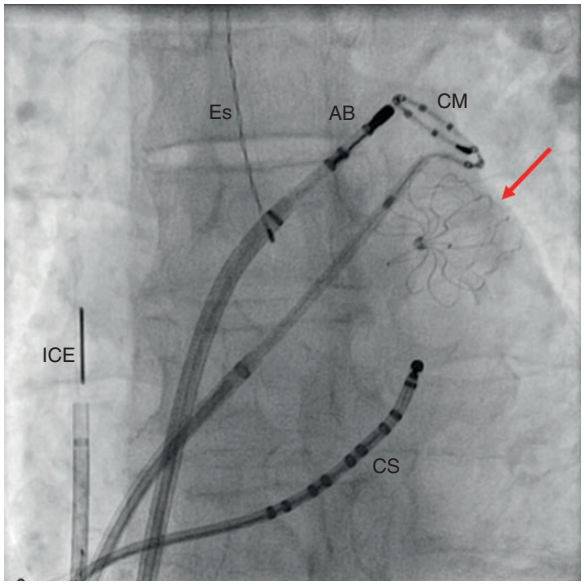

Figure 2 Fluoroscopic image during catheter ablation at the left superior pulmonary vein ostium in a patient with an implanted Watchman® device (arrowed). ICE, intracardiac echo catheter; Es, oesophageal temperature probe; AB, ablation catheter; CM, circular mapping catheter; CS, coronary sinus catheter.

Paroxysmal AF was the predominant recurrent arrhythmia in five patients, persistent AF requiring electrical cardioversions in three patients and atypical atrial flutter/atrial tachycardias in two patients. The mean duration between Watchman® implantation and the redo catheter ablation procedure was 375 ± 290 days (range 190–943 days). Nine patients had been on Aspirin prior to the procedure with one patient on warfarin for reasons of repeated electrical cardioversions. Stable seating of the Watchman® device had been demonstrated on TOE imaging in all patients prior to the procedure with no device associated or LA thrombus. Complete device occlusion of the LAA was noted in seven patients and a persistent 2 mm peri-device leak into the LAA noted in three patients.

Technical procedural outcome

A circular mapping catheter was successfully introduced into all left- and right-sided pulmonary veins for NavX geometry creation and to assess for recurrent pulmonary vein conduction in all patients (*Figure 2*). In three patients with recurrent persistent AF, a left atrial CFAE map was created with the circular mapping catheter, including mapping at the mouth of the LAA (*Figure 3*). In two patients, a complete 3D LA activation map was performed using the circular mapping catheter to demonstrate a perimitral flutter and a roof-dependent re-entrant flutter.

Ablation targets

Recurrent conduction into one or more pulmonary veins was identified in 8 of 10 patients. Gaps were identified and ablated around the left pulmonary veins in five patients, and around the right pulmonary veins in five patients, with electrical isolation achieved. Linear ablation was performed to treat left atrial flutters in two patients—a lateral mitral isthmus line and a left atrial roof line. A focal atrial tachycardia was mapped and ablated on the left interatrial septum in one patient. CFAE-guided focal ablation was performed in three patients targeting the LA roof or dome, interatrial septum and ridge between left superior pulmonary vein and LAA, or at the base or mouth of LAA. An LA posterior wall 'box' electrical isolation was performed in one patient (addition of LA roof and floor lines to confirmed pre-existing pulmonary vein electrical isolation) to treat extensive posterior wall scarring and CFAE zones.

Acute procedural success

Successful acute ablation endpoints were achieved in all patients, including complete pulmonary vein electrical isolation and return to stable sinus rhythm. The appearances of the Watchman® device position and device integrity were confirmed to be satisfactory in all patients at the end of the procedure based on fluoroscopy and ICE imaging. The mean total procedure time was 189 ± 61 min (range 130–290). The mean fluoroscopic time was 35 ± 12 min (range 24–59) and radiation dose area product (DAP) 11 ± 4 $Gycm^2$ (range 5–18). There were no acute procedural complications. All patients were discharged within 24 h of the procedure. One patient was discharged on uninterrupted warfarin, eight patients on dabigatran, and one patient on rivaroxaban therapy.

Clinical follow-up

Nine of 10 patients were in sinus rhythm at 3-month follow-up. Oral anticoagulation was discontinued and substituted with Aspirin in nine patients with one remaining on warfarin therapy for the purposes of repeated electrical cardioversions. Seven patients remain free of detectable arrhythmia at follow-up to date (mean 491 ± 243 days). Antiarrhythmic drug therapy was ceased in five patients. The six patients with a prior paroxysmal pattern of AF were all free of arrhythmia, with one patient electing to remain on antiarrhythmic drug therapy. One patient with persistent AF remains free of

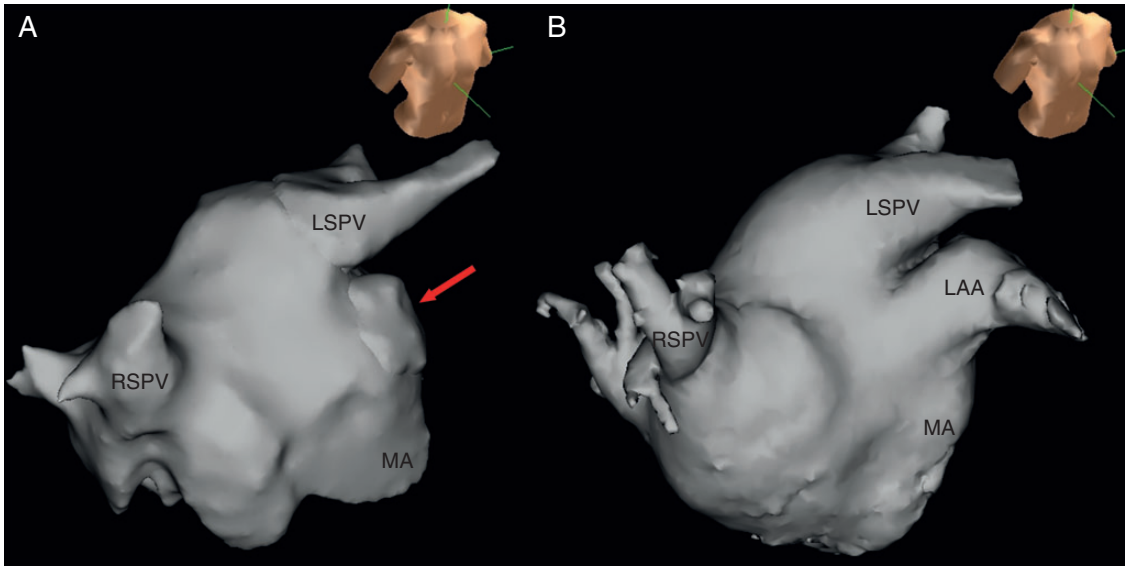

Figure 3 NavX left atrial geometry collected with a circular mapping catheter in a patient following Watchman® implantation is shown in (*A*) with the residual mouth of the LAA arrowed; (*B*) left atrial CT scan reconstruction for the same patient prior to Watchman® implantation showing LAA anatomy prior to device occlusion. LSPV, left superior pulmonary vein; RSPV, right superior pulmonary vein; LAA, left atrial appendage; MA, mitral annulus.

arrhythmia based on pacemaker monitoring, with adjunctive antiarrhythmic drug use. Two patients with longstanding persistent AF have required intermittent electrical cardioversions and adjunctive antiarrhythmic drug therapy to continue maintaining sinus rhythm. One patient with persistent AF has subsequently accepted permanent AF after further failures of electrical cardioversion on Amiodarone. No clinical neurological or embolic events were detected based on patient symptom reporting during follow-up to date since Watchman® implantation or subsequent to the redo left atrial catheter ablation procedure.

Discussion

The current study supports the feasibility of complex LA catheter mapping and ablation in the presence of a chronically implanted Watchman® LAA device. A wide range of LA tachyarrhythmias were able to be mapped and ablated in this small series including comprehensive LA chamber electro-anatomic mapping and CFAE ablation at the mouth of the LAA.

Long-term stability of the Watchman® device has been demonstrated to be excellent with no reports of device embolization beyond the 45-day timeframe.[2,9–11] Robust endothelialization of the Watchman® atrial surface by 28 days has also been demonstrated in a canine model[12,13] suggesting that tissue ingrowth is another source of chronic stability. In the current study, LA instrumentation was performed safely at a minimum timeframe of 190 days following Watchman® implantation. It remains unclear how soon, on average, after device implantation LA catheter ablation therapy could be considered.

Gentle apposition of the face of the circular mapping catheter with the Watchman® device surface was performed in several patients to collect CFAE or LA electrical activation information. However, extreme caution was used not to advance the ablation catheter tip at the Watchman device as it remains unclear whether the device fabric cap surface could be perforated under direct catheter pressure.

The LAA has been recognized to be a potential arrhythmogenic source in AF.[14] Accessibility of the LAA for catheter mapping and ablation is likely to be impaired in the presence of an implanted occlusion device. The position of the Watchman® device, however, within the anatomical ostium of the LAA still permits catheter access to the mouth or opening of the appendage as was demonstrated in this series. The previously described technique of LAA electrical isolation by encirclement of the ostium with ablation[14] therefore still appears technically feasible in the presence of a Watchman® device.

Study limitations

This initial experience pertains to a small number of procedures performed by an experienced high-volume operator and was combined with comprehensive pre-procedural assessment (cardiac CT scan and TOE assessment) and peri-procedural catheter display and imaging (NavX cardiac navigation and intracardiac echocardiography). The possibility of damage to the device, device dislodgement, or catheter entrapment should be considered a potential risk of any LA instrumentation procedure in the presence of an implanted LAA occlusion device. The authors emphasize that left atrial catheter manipulation in the presence of an occlusion device should be undertaken only with extreme caution. The experience from the current study cannot be extrapolated to other LAA device implants particularly in the light of multiple reports of late device embolization with the Amplatzer® Cardiac Plug.[15,16] An isolated case report of

successful left atrial catheter ablation in the presence of an Amplatzer® Cardiac Plug has been published.[17]

In the current study, focal ablation was performed successfully around the left pulmonary veins to target gaps in previous pulmonary vein antral ablation rings. The feasibility of performing wide area antral isolation around the pulmonary veins as a first-time ablation procedure has not been demonstrated. The requirement for more extensive catheter manipulation around the left pulmonary veins and ridge with the left atrial appendage might increase the possibility of complications or iatrogenic damage to the occluder device.

Future considerations

As the number of patients with non-valvular AF undergoing LAA device occlusion implants increases worldwide, there is a greater likelihood that a proportion of these patients will want to undergo subsequent left atrial catheter ablation techniques for rhythm control of their atrial fibrillation. Improved understanding of the healing and chronic stability of each design LAA occlusion device is required before LA instrumentation and catheter manipulation should be considered. Further experience is needed before conclusions can be drawn about the safety and generalizability of this technique.

Conclusions

Left atrial catheter ablation therapy in the presence of an implanted Watchman® LAA occlusion device was efficacious and uncomplicated in our small single centre experience.

Conflict of interest: K.P.P. has received Consulting Fees from Boston Scientific.

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