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ORIGINAL ARTICLE

Low Rates of Major Complications for Radiofrequency Ablation of Atrial Fibrillation Maintained Over 14 Years: A Single Centre Experience of 2750 Consecutive Cases

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Background Despite technological advances, studies continue to report high complication rates for atrial fibrillation (AF) ablation. We sought to review complication rates for AF ablation at a high-volume centre over a 14-year period and identify predictors of complications.

Methods We reviewed prospectively collected data from 2750 consecutive AF ablation procedures at our institution using radiofrequency energy (RF) between January 2004 and May 2017. All cases were performed under general anaesthetic with transoesophageal echocardiography (TEE), 3D-mapping and an irrigated ablation catheter. Double transseptal puncture was performed under TEE guidance. All patients underwent wide antral circumferential isolation of the pulmonary veins (30W anteriorly, 25W posteriorly) with substrate modification at operator discretion.

Results Of 2255 initial and 495 redo procedures, ablation strategies were: PVI only 2097 (76.3%), PVI + lines 368 (13.4%), PVI + posterior wall 191 (6.9%), PVI + cavotricuspid isthmus 277 (10.1%). There were 23 major (0.84%) and 20 minor (0.73%) complications. Cardiac tamponade (five cases – 0.18%) and phrenic nerve palsy (one case – 0.04%) rates were very low. Major vascular complications necessitating surgery or blood transfusion occurred in five patients (0.18%). There were no cases of death, permanent disability, atrio-oesophageal fistulae or symptomatic PV stenosis, although there were five TEE probe-related complications (0.18%). Female gender (OR 2.14; 95% CI 1.07–4.26) but not age >70 (OR 1.01) was the only multivariate predictor of complications.

Conclusions Atrial fibrillation ablation performed at a high-volume centre using RF can be achieved with a low major complication rate in a representative AF population over a sustained period of time.

Keywords Atrial fibrillation • Ablation • Radiofrequency energy • Complications • Cardiac tamponade

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Introduction

Q4 Over the past decade, performance of catheter ablation procedures for atrial fibrillation has increased exponentially [1]. However, in the context of a procedure performed primarily for quality of life, minimisation of complications remains critical. Both early and contemporary studies continue to report widely varying major complication rat

es; as low as 0.8% [2] in some series and as high as 9.1% in others [3]. Various reasons have been invoked to explain this variance including operator and hospital experience [4], reporting bias in voluntary registries [5], type of technology used, extent of the ablation procedure and patient population. We reviewed complication rates for AF ablation using radiofrequency energy (RF) at a high-volume tertiary referral Q5 centre over a 14-year period.

Methods

Study Population

This is a single-centre study of prospectively collected data of 2750 consecutive atrial fibrillation (AF) ablation procedures performed at the Royal Melbourne Hospital/Melbourne Private Hospital between January 2004 and May 2017. The primary indication for ablation was symptomatic paroxysmal or persistent AF refractory to medical therapy. All ablations were performed by one of four experienced interventional electrophysiologists with an electrophysiology fellow assisting.

AF Ablation Protocol

All AF ablations were performed using radiofrequency energy, general anaesthetic and either CARTO® (Biosense Webster, Diamond Bar, CA, USA) or NavX™ (St Jude Medical, St Paul, MA, USA) three-dimensional electroanatomical mapping systems. After induction of general anaesthesia, a transoesophageal echocardiogram (TOE) probe was routinely inserted by the attending anaesthetist or echocardiologist. Baseline TOE was performed to exclude left atrial (LA) thrombus and left in-situ to guide transseptal puncture, and then removed.

All catheters were inserted via the right femoral vein (two 8-French sheaths, one 7-French and one 6-French sheath), with ultrasound performed for difficult access in all cases, and routinely for cases from 2016 onwards. The internal jugular vein was used for difficult coronary sinus cannulation. Urinary catheters were inserted at the anaesthetist's discretion. Intracardiac catheters prior to transseptal included a decapolar coronary sinus (CS) catheter and a quadripolar His-bundle/right ventricular catheter. Double transseptal puncture was performed using a BRK™ needle via 8F and 8.5F long SL1 sheaths (St. Jude Medical). Puncture site was guided by fluoroscopy in left anterior oblique and right anterior oblique projections with the His and CS catheters used as anatomical landmarks, as well as TOE which defined the point of maximal septal tenting prior to crossing. Ablation and steerable circular multipolar pulmonary vein (PV) mapping catheters were then introduced into the left atrium (LA) using fluoroscopy. The mapping system then created LA and PV geometry. Surface registration with a pre-procedural computed tomography (CT) became standard practice from 2009.

All patients underwent point-by-point wide antral circumferential ablation of the left and right sided PVs using RF delivered through an irrigated catheter during CS-pacing (flow rate 17 mL/min). Power was maintained at 30W on the anterior surface and 25W posteriorly with up to 20 seconds of RF (posteriorly) or up to 30 seconds of RF (anteriorly) delivered at each point. The mapping catheter was used to confirm elimination of all PV potentials and enduring bidirectional block was the procedural endpoint. If PV reconnection developed after a waiting period of 30 minutes, additional RF lesions were applied. From 2010, intravenous adenosine (two doses, up to 18 mg) was used to assess dormant conduction at the discretion of the operator, and additional RF applied. Catheters and sheaths were then removed and a FemoStop™ vascular clamp applied to the Q6 femoral puncture site for 2 to 4 hours until haemostasis was achieved. A transthoracic echocardiogram at the completion of the procedure was performed in most cases to assess for pericardial effusion.

The anatomic location of the oesophagus was marked in all cases with the TOE probe which was removed following transseptal puncture prior to ablation. Oesophageal temperature monitoring was not routinely performed.

Lesion Sets

Additional lesions were performed at the discretion of the operator for persistent AF patients. These included lines at the LA roof, between the lateral mitral annulus and left inferior pulmonary vein, LA posterior wall isolation (roof and floor lines) and ablation of complex or fractionated electrograms (CFAEs). A cavotricuspid isthmus line was performed in patients with previous typical right atrial flutter or if sustained atrial flutter developed during the case. Bidirectional block was the target endpoint for all linear lesions.

Ablation Catheters

There was considerable evolution of irrigated catheter technology during the study period, including flexible bidirectional tips (D,F,J curve) conforming to tissue, advanced cooling mechanisms, and contact force-sensing (CF) spring mechanisms. The most commonly used catheters included Cool Flex™ and Flexability™ catheters (St Jude) and Navistar Thermocool™ and Thermocool SmartTouch™ (Biosense Webster). The Thermocool SmartTouch™ catheter (Biosense Webster) was introduced at our centre in 2011 and was the predominant CF catheter used for the remainder of the follow-up period. Target CF was ≥10 g and <40 g for lesion application. There were eight software and two hardware upgrades during the follow-up period.

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