

# Same-day cardiac catheter ablation is safe and cost-effective: Experience from a UK tertiary center



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**BACKGROUND** Catheter ablation is a curative intervention for common arrhythmias such as supraventricular tachycardia and atrial flutter. Many centers still admit patients overnight after this procedure.

**OBJECTIVE** This study was performed to evaluate the safety and cost-effectiveness of same-day standard catheter ablation.

**METHODS** We conducted a retrospective study of all consecutive elective same-day procedures performed between 2010 and 2014. Data were collected on baseline parameters, procedure details and success, postoperative complications, unplanned overnight hospital admissions, and clinical outcome (including mortality) at 4-month follow-up. A cost analysis of potential savings was also performed.

**RESULTS** A total of 1142 patients underwent planned same-day electrophysiological study with or without ablation. Radiofrequency ablation was performed in 897 of these patients (mean age  $\pm$  standard error  $56 \pm 0.6$  years, range 16–95 years, 467 males), with 921 arrhythmias ablated and with complete procedural success in 883 cases (96%). There were 92 unplanned admissions (10.3%): 50 for concealed pathways that required transseptal puncture, 19 for immediate complications (including 9 femoral bleeds and 5 pacemakers for heart block), 12 admitted at the

operator's discretion, and 11 for other clinical reasons. All had transthoracic echocardiography after the procedure, and none had significant pericardial effusion. At 4-month follow-up, there were 16 readmissions (1 deep vein thrombosis, 3 pericarditic chest pain, 2 femoral hematomas, 7 palpitations, and 3 others) and 1 death (unrelated to ablation). An overnight stay at our center costs \$450 (£300); same-day ablation over this period saved our institution \$365,000 (£240,000).

**CONCLUSION** Same-day standard catheter ablation is safe and cost-effective, with significant benefits for patients and health care providers. This is particularly important given the current financial climate.

**KEYWORDS** Cost efficacy; Health care economics; Safety; Same-day catheter ablation

**ABBREVIATIONS** AF = atrial fibrillation; AV = atrioventricular; AVNRT = atrioventricular nodal reentrant tachycardia; CA = catheter ablation; CTI = cavotricuspid isthmus; EPS = electrophysiological study; RVOT = right ventricular outflow tract

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## Introduction

Catheter ablation (CA) is a recognized curative intervention for common cardiac arrhythmias.<sup>1</sup> Standard CA<sup>2</sup> for common arrhythmias such as supraventricular tachycardia and type 1 atrial flutter is known to have high success and low complication rates.<sup>1,3</sup> Many centers still admit patients overnight for standard CA; however, use of same-day CA may benefit both patients and health care providers by

reducing logistic constraints on hospital resources, especially in the current financial climate. There is a paucity of data on the safety and efficacy of such practice.<sup>4,5</sup> We have been performing standard same-day CA at our institution since 2010. We evaluated the safety and efficacy of this policy and performed a cost analysis of savings made by our hospital by adopting this policy.

## Methods

### Study design

We performed a retrospective analysis of all consecutive elective patients who underwent standard same-day CA at

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University Hospital Coventry, Coventry, United Kingdom, between February 2010 and August 2014. For the purpose of this study, standard CA was defined as any cardiac ablation performed percutaneously via intravascular access that was not known to require elective transseptal puncture at the start of the procedure. Patients who were admitted to the hospital as inpatients and who underwent CA during the same admission were excluded, as were all those who only had an electrophysiological study (EPS) performed, because they are discharged home the same day in most cases anyway. Data were collected on baseline patient demographics, procedure details, ablation success, postoperative complications, and outcome at 4-month follow-up, including mortality. Approval for the study was obtained from our hospital's research and audit department. Our protocol for same-day ablation was to include all patients who required standard CA and who were not known to need transseptal puncture from the outset. Those who lived further away from the hospital were listed earlier than those who lived closer, to allow timely discharge. Age and geography were not specifically used to exclude patients; exceptions were made on the day of the procedure at the operator's discretion.

### Procedure details

All procedures were performed at University Hospital Coventry by a consultant electrophysiologist using a femoral venous approach with local anesthesia (1% lidocaine) and conscious sedation (most often midazolam, 0.1 mg/kg intravenously). A 3-wire EPS<sup>6</sup> was performed percutaneously through 3 femoral venous punctures (single 7F and two 6F sheaths), with quadrapolar catheters placed at the His bundle position and right ventricular apex and a decapolar catheter placed within the coronary sinus. No patient had internal jugular or subclavian vein punctures performed. For patients having cavotricuspid isthmus (CTI) ablation for atrial flutter, a catheter was positioned at the tricuspid valve annulus and another within the coronary sinus. The EPS was performed by use of standard techniques, and diagnosis of arrhythmias was established according to previously published standards.<sup>7</sup> If the EPS was negative at baseline, an isoprenaline infusion (initial 4 µg bolus) with washout with or without atropine 200–500 µg was administered and the stimulation protocol repeated. For patients with documented CTI-dependent atrial flutter who were in sinus rhythm at the time of the EPS, CA of the CTI was performed directly during coronary sinus pacing after a baseline EPS. Patients who had CTI ablation had to be undergoing therapeutic oral anticoagulation (with a vitamin K antagonist or novel oral anticoagulant agent) for at least 3 weeks before the procedure (international normalized ratio on the day of the procedure had to be 2–4 to proceed) and continued that regimen at least until the first review, unless stated otherwise. All other patients received aspirin 300 mg before the procedure (or clopidogrel 300 mg if they had an aspirin allergy), followed by a 6-week course of aspirin 150 mg/d (clopidogrel 75 mg/d if aspirin allergy). If atrial fibrillation (AF) was induced

during the EPS, external electrical cardioversion was performed under conscious sedation.

Cardiac ablation of atrioventricular nodal reentrant tachycardia (AVNRT), accessory pathways, and atrioventricular (AV) node was performed with a 4-mm-tip Quadrapolar temperature-controlled, nonirrigated ablation catheter. Ablation of atrial tachycardia, CTI-dependent atrial flutter, and right ventricular outflow tract (RVOT) ectopics was performed with a 4-mm-tip Quadrapolar temperature-controlled, irrigated catheter. Ablation of RVOT ectopics was performed with the Velocity Array noncontact mapping system (St. Jude Medical, Minneapolis, MN), and patients were given 5000 U of heparin once the array was deployed in the correct location.

After the procedure, all catheters and sheaths were removed, and manual compression was applied until complete hemostasis was achieved. A targeted transthoracic echocardiogram was performed in all patients immediately after the procedure in the laboratory by the primary operator. This is standard practice after all ablations at our center, given that we have a dedicated echocardiography machine and the performance of a targeted echocardiogram adds only a few minutes to the procedure with no additional cost implications. After the procedure, patients were observed in our cardiac day-case unit with monitoring of blood pressure, pulse, and puncture sites, and all had a resting 12-lead electrocardiogram performed (before and after ablation). Patients were reviewed by the operator 3–4 hours later and discharged from the hospital if well. Patients who needed a transseptal puncture were kept overnight for observation and discharged home the next morning. If for any reason there were concerns about same-day discharge, patients were admitted overnight and discharged the following day. Those discharged were instructed not to undertake strenuous physical activity for several days. In case of any problems, patients were advised to contact the cardiology day-case unit or cardiology ward immediately. All patients were reviewed 4 months after ablation in the Arrhythmia Outpatient Clinic with an assessment of clinical symptoms and repeat 12-lead electrocardiogram. All were questioned specifically about any complications that may have occurred since the procedure, especially those that required admission to a hospital.

### Outcome measures

Successful endpoints after cardiac ablation were defined as follows: for CTI ablation, bidirectional CTI block demonstrated with differential atrial pacing maneuvers after a 30-minute wait; for accessory pathways, demonstration of AV and ventriculoatrial block with intravenous adenosine after a 30-minute wait; for atrial tachycardia, noninducibility with isoprenaline infusion and pacing maneuvers after a 30-minute wait; for AVNRT slow-pathway modification, arrhythmia noninducibility with isoprenaline infusion and washout (single jump and echo beat were allowed); for RVOT ectopic ablation, noninducibility of RVOT ectopics with pacing maneuvers after a 30-minute wait; and for AV

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