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Epicardial electrical dissociation with endocardial conduction following deployment of an epicardial left atrial appendage closure device

Benedict M. Glover[1]*, Kathryn L. Hong[1], Damián Sánchez-Quintana[2], and Gianluigi Bisleri[3]

[1]Cardiac Electrophysiology, Schulich Heart Centre, 2075 Bayview Avenue, Toronto, ON M4N 3M5, Canada; [2]Department of Anatomy and Biology, University of Extramadura, Avda de Elvas, Badajoz 06006, Spain; and [3]Department of Surgery, Queens University, 76 Stuart Street, Kingston, ON K7L 2V7, Canada

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Introduction

The left atrial appendage (LAA) accounts for 90% of clots in non-valvular atrial fibrillation (AF)[1] and contains anisotropic tissue at the junction with the left atrium (LA) which may result in the initiation and maintenance of AF.[2] Minimally invasive epicardial closure may reduce the risk of thromboembolism and electrically isolate the LAA from the LA. Complete endocardial LAA electrical isolation using radiofrequency (RF) catheter ablation has been shown to reduce the recurrence rate of AF to 15% compared with 68% for focal ablation of LAA triggers and 74% with no ablation.[3] Despite this early LAA reconnections (within 30 min) may occur in 50–70% of endocardial isolations requiring further RF ablation with an acute isolation rate of over 90%.[4] Late LAA reconnections (up to 3 months) may occur in almost 30% of complete endocardial isolations.[5]

Mechanical exclusion of the LAA may reduce the production of important peptides such as atrial natriuretic peptide which plays a key role in the maintenance of blood volume and blood pressure.[6] When considering closure of the LAA, it is important to understand the complex anatomy and electrical innervation of this structure.

Although epicardial LAA isolation has been shown to result in epicardial conduction block,[7] we describe a case of acute epicardial electrical isolation with continued endocardial conduction. This may imply that the use of an epicardial closure device does not always result in complete electrical isolation which may reflect the complex anatomy of the innervation of the LAA.

Case

A patient with symptomatic long-standing persistent AF underwent hybrid catheter ablation and concomitant LAA closure following failed antiarrhythmic drug therapy. High-resolution endocardial and epicardial mapping of the LA was performed using the EnSite Precision mapping system (Abbott, Inc., St. Paul, MN, USA). Following isolation of the LA posterior wall and pulmonary veins LAA closure were performed using a 40-mm AtriClip (AtriCure, West Chester, OH, USA). A high definition (HD) grid mapping catheter was positioned in the LAA endocardium, while the clip was deployed and at the same time another HD grid was positioned on the LAA epicardium.

As shown in *Figure 1A* baseline endocardial signals (blue circle) remained whilst epicardial signals (red circle) significantly diminished over a duration of 10 min. High-resolution mapping of the LAA epicardium (*Figure 1B*) superimposed on the endocardial voltage map showed electrical voltages less than 0.5 mV (yellow and red) suggesting epicardial electrical isolation. These findings are in line with previous knowledge that the Bachmann bundle has both endocardial and epicardial innervation (*Figure 1C*) and that epicardial closure may interrupt only some of these fibres which may be separated by blood vessels and fat, impacting transmural conduction block. The fluoroscopic locations of the LAA epicardial clip and mapping catheters are shown in *Figure 1D*.

* Corresponding author. Tel: 4164806100 (ext 7370), Fax: 4164805069, Email: Benedict.glover@sunnybrook.ca
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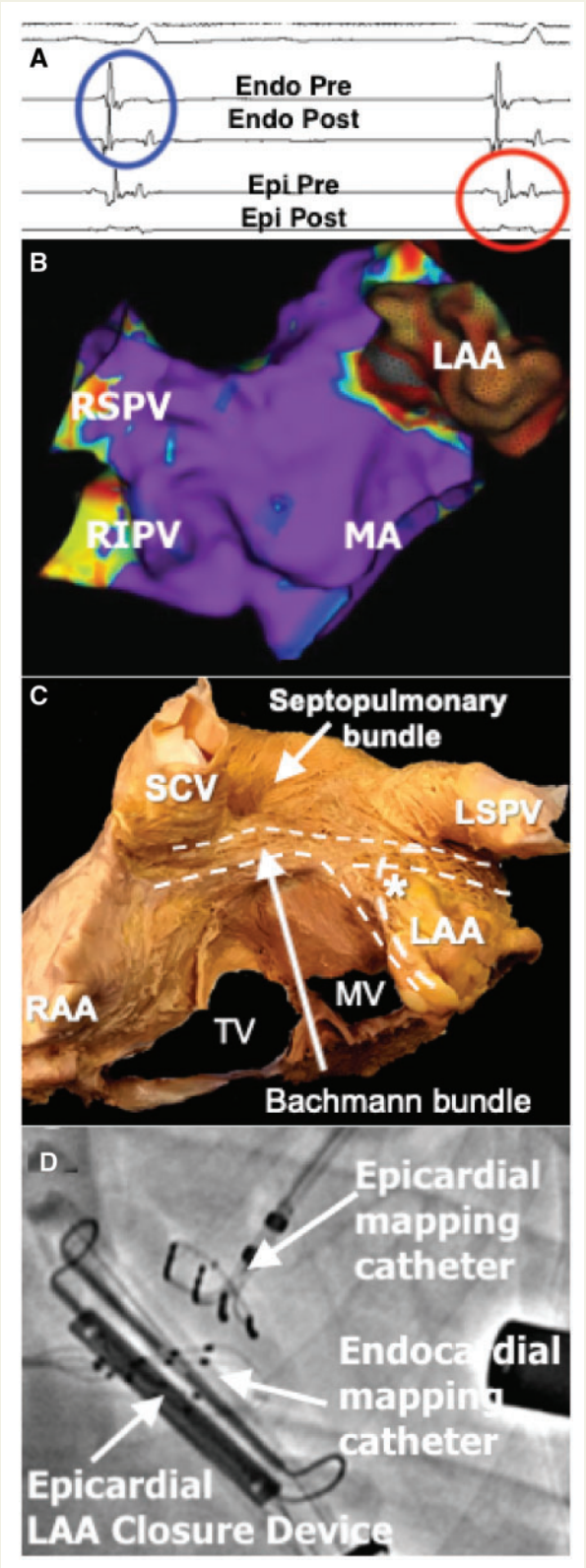

Figure 1 Electrograms recorded from the endocardial left atrial appendage (blue circle) and epicardial left atrial appendage (red circle) show a significant reduction in the voltage on the epicardial surface implying electrical isolation with continuation of the signals on the endocardium implying continued conduction. (*A*) This was also demonstrated using an endocardial voltage map with a superimposed epicardial map showing voltages greater than 0.5 mV (purple) in the endocardium with voltages less than 0.5 mV on the epicardial left atrial appendage (red and yellow) which is considered to demonstrate electrical isolation on the epicardial surface. (*B*) The endocardial and epicardial electrical connections between the atria and left atrial appendage are shown in (*C*) in which fibres from Bachmann bundle separate out onto the endocardial and epicardial surfaces (asterisk) The fluoroscopic image of the epicardial left atrial appendage closure device and the mapping catheters on the epicardial and endocardial surfaces of the left atrial appendage are shown in (*D*). The high-voltage threshold depicting healthy conductive tissue was set to ≥0.5 mV. Voltage measurements <0.5 mV is considered to be low-voltage non-conductive tissue. The low-voltage threshold depicting potential scar tissue was set to <0.05 mV. Maps were created in sinus rhythm. Interior and exterior projection was set to 6 mm with interpolation of each data point set to 8 mm. Endo Post, endocardial postclosure; Endo Pre, endocardial preclosure; Epi Post, epicardial postclosure; Epi Pre, epicardial preclosure; LAA, left atrial appendage; LSPV, left superior pulmonary vein; MV, mitral valve; RAA, right atrial appendage; RIPV, right inferior pulmonary; RSPV, right superior pulmonary vein; SCV, superior caval vein; TV, tricuspid valve.

This case demonstrates that transmural electrical block may not occur at least in the short term following deployment of an epicardial LAA closure device.

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: B.M.G. receives research funding and consultancy fees from Abbott technologies.

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