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CASE REPORT

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Radiofrequency atrial flutter and atrial fibrillation ablation in a patient with deep brain stimulation

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Key Clinical Message

Radiofrequency ablation for atrial fibrillation or atrial flutter is feasible in patients with deep brain stimulation but with extreme caution given the possibility of life-threatening complications.

KEYWORDS

atrial fibrillation ablation, atrial flutter, deep brain stimulation, Parkinson disease, radiofrequency ablation, Takotsubo syndrome

1 | INTRODUCTION

Parkinson disease (PD) is one of the fastest growing neurological disorders and its prevalence is expected to double in the next two decades.[1]

Deep brain stimulation (DBS) is an advanced treatment for PD's motor symptoms and several other neurological conditions.[2,3] It is known to induce significant ECG artifacts.[4,5] There is a concern for brain damage due to local heating in proximity to the DBS electrode while using diathermy although experimental data with monopolar electrosurgery has actually shown minor temperature elevations and no tissue damage.[6–8]

Supraventricular tachycardia ablation has been successfully performed in PD patients with DBS, and atrioventricular nodal reentrant tachycardia ablation has been performed with radiofrequency ablation, cryoablation and 3D impedance-based electroanatomic mapping (EAM) system.[9–12] Cryoballoon pulmonary vein isolation and intracardiac defibrillation was also described in a patient with paroxysmal atrial fibrillation (AF).[13]

2 | CASE HISTORY—METHODS AND RESULTS

A 51-year-old man presented to the emergency department for new-onset palpitations and dizziness. ECG showed AF with significant sinus pauses at the offset of AF. The patient was admitted for further monitoring and treatment. Past medical history included asymptomatic sinus bradycardia, recurrent venous thromboembolism and severe PD with the implant of a DBS device (Medtronic Percept PC, Medtronic, Minnesota, USA) 3 months before presentation. Medications were levodopa, ropinirole, alprazolam, rivaroxaban, domperidone.

Baseline ECG showed sinus bradycardia and the echocardiogram showed normal LVEF with mild biatrial dilatation. Either AF catheter ablation or a dual-chamber pacemaker implant was suggested. After shared decision-making, the patient was scheduled for inpatient AF ablation on uninterrupted rivaroxaban.

The treating neurosurgery team advised disabling DBS during the AF ablation planned under general anesthesia and to check the device a few weeks after discharge.

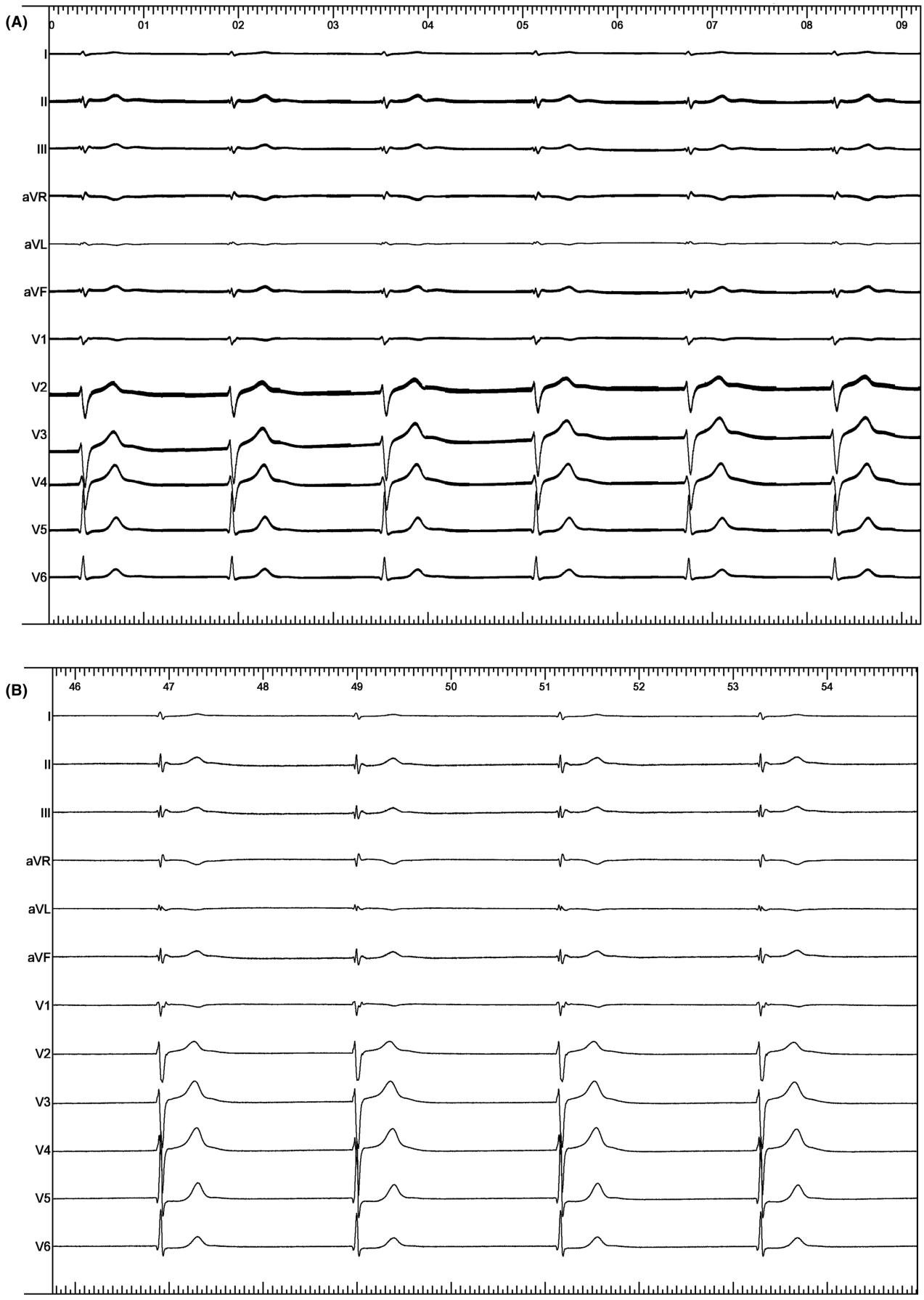

FIGURE 1 (A) Baseline 12-lead Electrocardiogram with deep brain stimulation (DBS) activated. (B) Baseline 12-lead Electrocardiogram with DBS disabled.

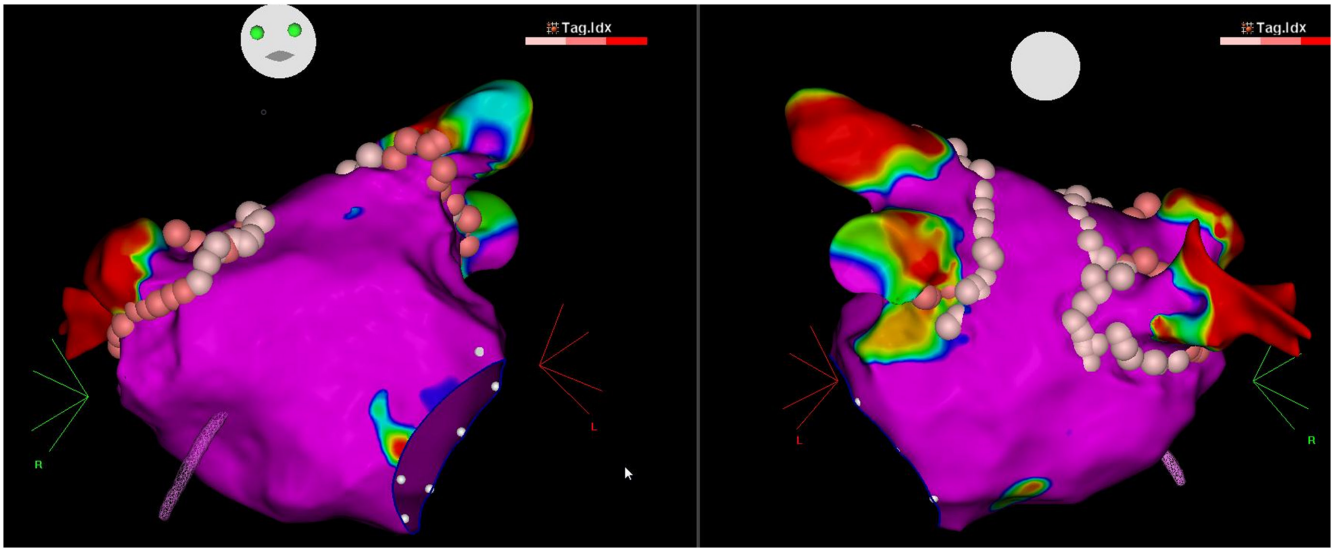

FIGURE 2 3D electroanatomical map of the left atrium (LA) after pulmonary vein isolation in anterior and posterior views.

Figure 1A,B show the 12-lead ECG with DBS enabled and disabled.

The DBS device was disabled after anesthesia induction using the patient controller. Transoesophageal echocardiography excluded intracardiac thrombus. Empirical cavotricuspid ablation was performed followed by left atrium (LA) access; an LA anatomical and voltage map created by a 3D electroanatomic system (Carto v6, Biosense Webster, CA, USA) and circular mapping catheter (Lasso), which showed normal voltage and a severely enlarged LA (164 cc). Point-by-point radiofrequency bilateral pulmonary vein isolation was performed (Figure 2) with an irrigated contact-force enabled ablation catheter (Thermocool Smarttouch, Biosense Webster, CA, USA), the cavotricuspid isthmus was still bidirectionally blocked and total radiofrequency time was 36 min. DBS was reactivated before the offset of general anesthesia. The patient developed urinary retention which was treated with the insertion of a urinary catheter in the immediate postoperative period.

3 | OUTCOME AND FOLLOW-UP

In the recovery room, he was found to be hypotensive despite fluid expansion, bedside echocardiogram showed an LVEF of 20% without pericardial effusion. An urgent coronary angiogram demonstrated normal coronary arteries and midventricular Takotsubo syndrome (supplementary material Video S1). The 12-lead ECG was unchanged from the end of the procedure with accelerated junctional rhythm and normal repolarisation at 90 bpm. Given elevated lactate and NT-proBNP, the patient was started on dobutamine and noradrenaline and admitted to the intensive care unit. He was transferred to the cardiology ward after 3 days of inotropic support and 24 h without vasoactive agent.

A follow-up echocardiogram showed normalized LVEF. He made a full recovery and was discharged 7 days post ablation. He has had no symptoms or any atrial arrhythmia 1.5 years post-procedure and the DBS' subsequent interrogations have shown no abnormality.

4 | DISCUSSION

Our case shows that radiofrequency AF ablation with magnetic-based 3D EAM system is feasible in patients with DBS. The use of general anesthesia allows disabling the DBS device without exacerbating movement disorders, which might hinder the creation and use of a 3D map. Disabling the DBS also removes any potential artifact to the ECG and EP recording system during the ablation procedure. Our case widens the described experiences of arrhythmia ablation in patients with DBS. The presence of DBS appears not to be an obstacle for radiofrequency ablation of arrhythmias. Further experience will be needed to confirm our experience and to determine whether it is possible and safe to perform radiofrequency ablation with a magnetic-based 3D EAM without disabling DBS.

Takotsubo syndrome or cardiomyopathy is defined as a transient cardiac wall motion abnormality accompanied by electrocardiographic changes, elevated biomarkers (troponin, NT-proBNP) and signs and symptoms similar to an acute myocardial infarction. The range of clinical presentation varies between an incidental echocardiographic finding to cardiogenic shock or cardiac arrest.[14] Takotsubo syndrome can be triggered by emotional triggers (argument, death of

a family member) or physical triggers (acute medical events such as stroke, infection, hemorrhage, or medical procedures/operations, anesthesia). The most common wall motion abnormality is an apical ballooning (typical Takotsubo syndrome) but atypical variants have been described: midventricular, basal and focal wall motion patterns. Treatment is essentially supportive with ACE inhibitors, beta-blockers and intensive care unit admission for patients with hemodynamic impairment.[15] The natural history of Takotsubo is spontaneous resolution and the prognosis is similar to patients with acute coronary syndrome.[16]

Interestingly, our patient experienced midventricular Takotsubo syndrome after the procedure. This complication might be due to several factors including the AF ablation itself, the use of general anesthesia and possibly the temporary withdrawal of DBS.

Takotsubo syndrome has rarely been described after AF ablation.[17–20] In addition, DBS was disabled for the entire procedure and manifestations of DBS withdrawal range from motor symptoms to life-threatening events.[21,22] To our knowledge, Takotsubo syndrome has never been described after withdrawal of DBS. This emphasizes the need for careful monitoring after a radiofrequency ablation procedure in patients with DBS.

5 | CONCLUSION

In summary, we describe the successful use of radiofrequency ablation for cavotricuspid isthmus, pulmonary vein isolation with 3D electroanatomical mapping in a patient with Parkinson disease and deep brain stimulation despite the development of severe Takotsubo syndrome post-procedure.

AUTHOR CONTRIBUTIONS

Thomas Nguyen: Conceptualization; investigation; writing – original draft; writing – review and editing. **Gildas Ganse:** Investigation; writing – review and editing. **Brahim Berdaoui:** Investigation; writing – review and editing. **Thierry Verbeet:** Writing – review and editing. **José Castro-Rodriguez:** Supervision; writing – review and editing.

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FUNDING INFORMATION

Not applicable.

CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest with this manuscript.

DATA AVAILABILITY STATEMENT

Data and materials are available upon request to the corresponding author.

ETHICS STATEMENT

Not applicable.

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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