Unlocking the Puzzle: Decoding Branch-to-Branch Ventricular Tachycardia in Ischemic Heart Disease

Une tachycardie ventriculaire de branche à branche chez un patient présentant une cardiopathie ischémique

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SUMMARY

Ventricular tachycardia (VT) is a life-threatening arrhythmia with various causes. Bundle branch reentrant (BBR) tachycardia is a form of ventricular tachycardia (VT) incorporating both bundle branches into the reentry circuit. We report here the case of a 67-year-old patient with a medical history of diabetes, arterial hypertension, and coronary artery disease. He was admitted to our cardiology department with a Bundle branch re-entrant VT. Transthoracic echocardiography confirmed the presence of ischemic dilated cardiomyopathy, with reduced systolic function. A Simple Chamber implantable cardioverter-defibrillator was implanted for secondary prevention.

KEYWORDS

Bundle branch reentrant tachycardia, ischemic cardiomyopathy, defibrillator

RÉSUMÉ

La tachycardie ventriculaire (TV) est une arythmie potentiellement mortelle dont les causes sont diverses. Nous rapportons ici le cas d'un patient de 67 ans ayant des antécédents médicaux de diabète, d'hypertension artérielle et de coronaropathie. Il a été admis dans notre service de cardiologie pour une TV de branche à branche. L'échocardiographie transthoracique a confirmé la présence d'une cardiomyopathie dilatée ischémique, avec une fonction systolique réduite. Un défibrillateur automatique implantable a été implanté pour la prévention secondaire.

MOTS-CLÉS

Tachycardie entriculaire, cardiopathie ischémique, éfibrillateur automatique implantable

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BACKGROUND

Ventricular tachycardia (VT) is a life-threatening arrhythmia with various causes. Bundle branch reentrant (BBR) tachycardia is a form of ventricular tachycardia (VT) incorporating both bundle branches into the reentry circuit. It classically associated with dilated cardiomyopathy. This case report presents a challenging instance of poorly tolerated branch-to-branch VT for a patient with ischemic heart disease.

CASE REPORT

A 67-year-old patient with a medical history of diabetes, arterial hypertension, and coronary artery disease, underwent stenting in 1990 and subsequent bypass surgery in 2012. In 2013, the patient underwent a percutaneous coronary intervention (PCI) of the Left internal mammary artery (LIMA) graft and the Left anterior descending artery (LAD).

The patient was admitted to our cardiology department due to poorly tolerated VT, which was characterized by a regular tachycardia with wide QRS complexes. Initial electrocardiogram (ECG) findings revealed VT at a rate of 176 with a left bundle branch block pattern (figure1). Prompt intervention involved a synchronized biphasic 200 J external electrical cardioversion (EEC), which successfully terminated the VT.

Post-EEC ECG findings displayed a regular sinus rhythm with incomplete left bundle branch block.

Coronary angiography revealed not significant stenosis in several coronary arteries and bypass grafts. Transthoracic echocardiography (TTE) confirmed the presence of ischemic dilated cardiomyopathy, with reduced systolic function (LVEF = 30%) and severe akinesia affecting the inferior and inferoseptal walls.

Biology analysis findings revealed kalaemia at 3.7 mmol/l and correct magnesemia.

The patient was treated with beta blocker and amiodarone.

Implantable cardioverter defibrillator was proposed but refused by the patient.

Few days after, a recurrence of poorly tolerated VT occurred at a rate of 152 with a right bundle branch block pattern. A 200 J biphasic synchronous EEC, delievered under general anesthesia. (Figure 5)

Tachycardia with a QRS configuration which resembles that in sinus rhythm is usually thought to be supraventricular. However, the fact that the patient has LBBB at baseline, and this second ECG has RBBB, makes SVT (sinus, PSVT, flutter) with LBBB-aberrancy in the first ECG virtually impossible. Therefore, ultrasound and electrical findings suggest a bundle branch Reentry ventricular tachycardia.

A Simple Chamber implantable cardioverter-defibrillator (ICD) was implanted for secondary prevention. (Figure 6)

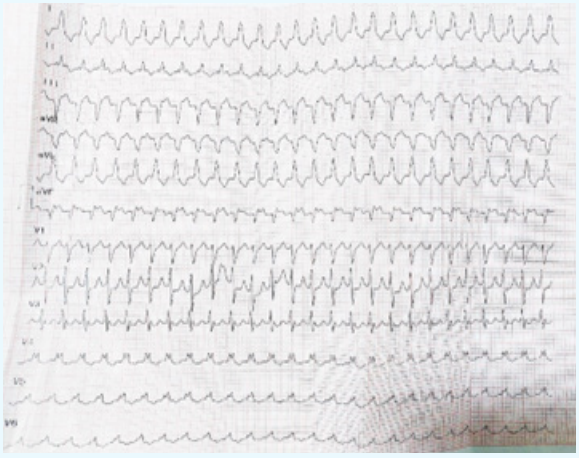

Figure 1. VT with left bundle branch block pattern.

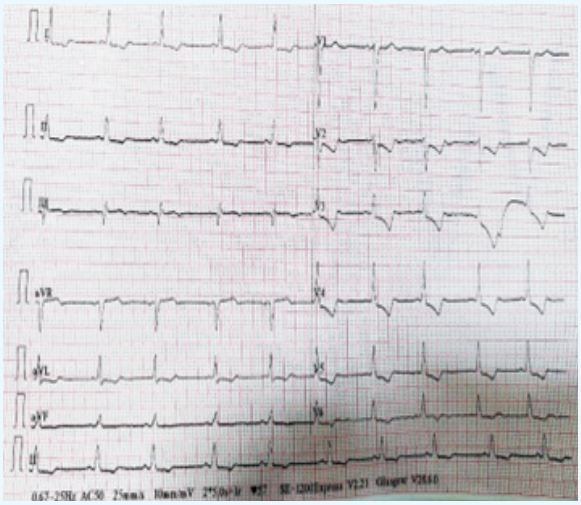

Figure 2. Regular sinus rhythm with complete bundle branch block

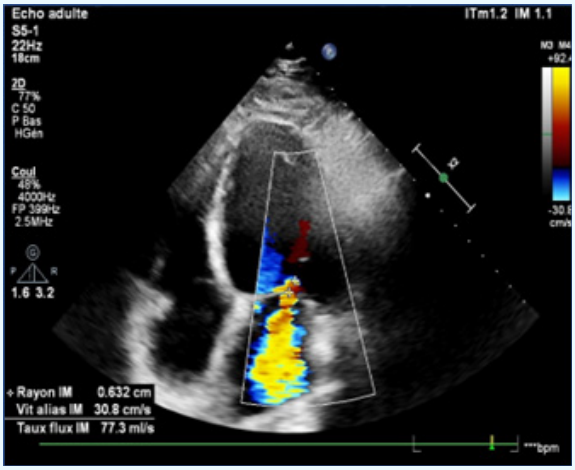

Figure 3. Moderate ischemic mitral regurgitation

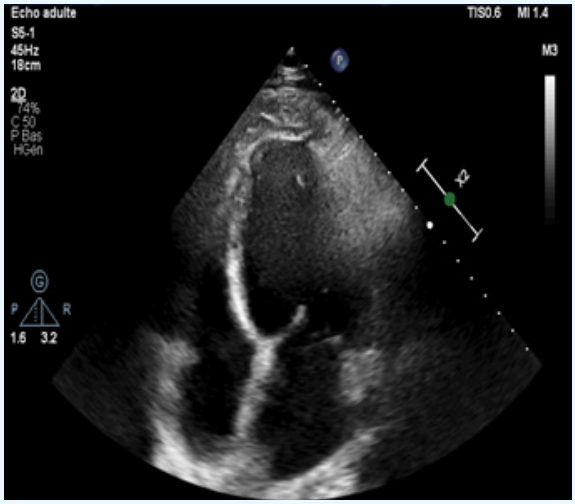

Figure 4. Ischemic dilated cardiomyopathy

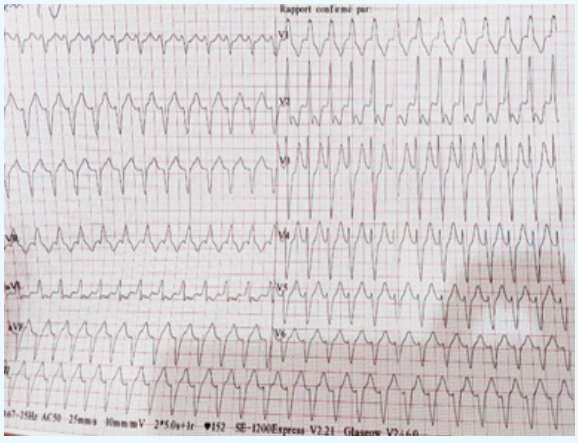

Figure 5. VT with a right bundle branch block pattern

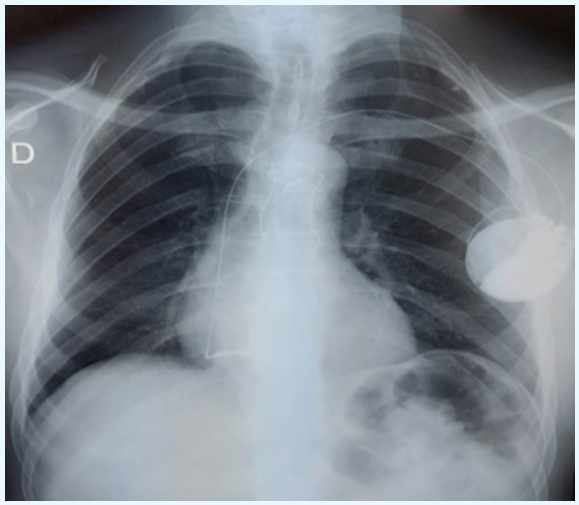

Figure 5. Chest X-Ray showing implanted **cardioverter** defibrillator

DISCUSSION

BBRVT (Bundle branch re-entrant ventricular tachycardia) is a life-threatening arrhythmia occurring secondary to macro–re-entry within the His-Purkinje system (1).

BBRVT is often observed in patients with acquired heart diseases, such as dilated cardiomyopathy, coronary artery disease, valvular heart disease, and myotonic myocardial dystrophy (2), which might involve the HIS-Purkinje system, and therefore would lead to the slow conduction within Purkinje system and facilitate the occurrence of bundle branch reentry VT (2).

Patients with BBRVT usually present severe symptoms with presyncope, syncope, or sudden death because of the rapid heart rate during tachycardia. This VT, in which both left and right bundle branches (LBBs and RBBs) are incorporated into a macro-reentrant circuit as the mechanism, is less common clinically. The BBRVT circuit most often consists of antegrade conduction along the right bundle branch followed by transseptal intramyocardial conduction and retrograde conduction along the left bundle branch. This manifests as a left bundle branch block pattern on the electrocardiogram (ECG), although a right bundle branch block pattern may also be observed when circuit propagation is in the opposite direction (3).

Surface ECG in sinus rhythm characteristically shows intraventricular conduction defects with or without PR interval prolongation. The conduction defects are presented by non-specific or typical bundle branch block patterns with

prolonged QRS duration. Although total interruption of conduction in one of the bundle branch would theoretically prevent occurrence of bundle branch reentry, an ECG pattern of "complete" bundle branch block may not be an accurate marker of complete conduction block (3).

Tachycardia with a QRS configuration which resembles to the sinus rhythm is usually thought to be supraventricular. Ventricular tachycardia, with a similar QRS configuration to that in sinus rhythm on the 12-lead ECG, can occur (4). BBRVT diagnosis was established according to previously published criteria: (1) QRS complex morphology of the VT exhibiting a typical bundle branch block (BBB) pattern consistent with ventriculo-atrial dissociation or a retrograde Wenckebach conduction; (2) His or BB electrogram preceding each ventricular activation during tachycardia with an HV interval longer than that recorded during SR; (3) spontaneous variation in VV intervals preceded by similar changes in HH or RB-RB intervals; (4) tachycardia termination by spontaneous or pacing-induced block in the HPS; and (5) inability to reinduce BBRVT after successful ablation of the RBB or LBB. If VT was induced but did not fulfill these criteria, then BBRVT was ruled out (2).

It is well known that patients with BBRVT often have longer HV interval when compared with baseline, and the mechanism underlying BBRVT is also well studied. The main reason underlying the development of BBR-VT is conduction impairment of the HPS, regardless of its cause. However, this impairment is diffused, not localized. BBRVT often involves both RBB and LBB conduction disturbances (2).

The available data on long-term outcome of patients with BBR VT treated by catheter ablation come from small retrospective series including predominantly patients with left ventricular dysfunction. These data suggest that the prognosis depends on the underlying cardiac disease. Patients with dilated cardiomyopathy and poor systolic LV function, especially those who have inducible VT other than BBR, are at high risk of non-BBR VT recurrence and sudden death despite successful abolition of bundle branch reentry. Progressive heart failure is a common cause of death in this population of patients. Therefore, most of these patients should be considered for an implantable cardiovertor-defibrillator (ICD) with or without cardiac resynchronization capabilities. Because BBR VT has a limited response to antiarrhythmic drugs and can be an important cause of repetitive ICD therapies, catheter ablation of the arrhythmia should always be considered as an important adjunct to the device therapy (3).

CONCLUSION

Bundle branch reentrant (BBR) tachycardia is an uncommon form of ventricular tachycardia (VT) incorporating both bundle branches into the reentry circuit. The arrhythmia is usually seen in patients with an acquired heart disease and significant conduction system impairment, although patients with structurally normal heart have been described. The technique of choice is ablation of the right bundle. Long-term outcome depends on the underlying cardiac disease. Patients with poor systolic left ventricular function are at risk of sudden death or death from progressive heart failure despite successful BBR VT ablation and should be considered for an implantable cardiovertor-defibrillator.

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