ECG Quiz

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ECG Quiz

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Introduction

A 45-year old man who had idiopathic dilated cardiomyopathy presented to the Accident and Emergency Department with near syncope. Blood pressure was 70/40mmHg and his ECG was shown in Figure 1. Emergency DC cardioversion was delivered and the post-cardioversion ECG was shown in Figure 2. What was the ECG diagnosis in Figure 1?

Figure 1. Wide complex tachycardia in the patient with dilated cardiomyopathy.

Figure 2. Baseline ECG after cardioversion.
1) a) Ventricular tachycardia (VT)
   b) Supraventricular tachycardia (SVT) with bundle branch block?

Electrophysiology study was performed for this patient. Monomorphic VT with cycle length 300ms was inducible. Significant hypotension was noticed during VT and overdrive pacing was able to terminate the VT. He was in NYHA functional class III with severe restriction in daily activity. His latest echocardiogram showed the left ventricular (LV) ejection fraction was 25%. In view of his hemodynamically unstable VT and poor functional capacity, a device was implanted to manage both arrhythmia and heart failure problems. The ECGs of this device with different pacing modes were shown in Figures 3-5. What was the device?

2) a) Dual-chamber pacemaker
    b) Implantable Cardioverter Defibrillator (ICD)
    c) Biventricular ICD

![Figure 3. Biventricular Pacing](image)

![Figure 4. Left ventricular pacing.](image)
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Figure 5. Right ventricular pacing.

Answers

1) a) Ventricular tachycardia
2) b) Biventricular ICD

Discussion

This patient had idiopathic dilated cardiomyopathy and presented with near syncope and wide complex tachycardia. In regards to his underlying poor LV function, ventricular tachycardia was the diagnosis until proven otherwise. Emergency cardioversion was the treatment of choice to terminate the hemodynamically unstable tachycardia. Although there are many diagnostic criteria to distinguish VT from SVT with aberrant conduction, it seems that underlying heart disease with impaired LV function is still one of the major criteria to diagnose VT. There was change of QRS axis during tachycardia when compared to resting ECG. Moreover, there was a switch from left bundle branch block (LBBB) in sinus rhythm to right bundle branch block (RBBB) morphology during tachycardia. One specific form of VT worth mentioning in patients with dilated cardiomyopathy is bundle branch re-entry VT. This specific form of VT accounts for 41% of all inducible sustained monomorphic VT in patients with idiopathic cardiomyopathy. The bundle branch re-entry VT usually has the LBBB QRS configuration on ECG. The proposed mechanism of this specific form of VT is macro-reentry within the bundle branches with antegrade conduction via right bundle branch and retrograde conduction via left bundle branch. The importance of diagnosing this specific form of VT is that radiofrequency ablation of right bundle branch can eliminate this form of VT. However, it is not uncommon to have more than one form of VT in these patients with dilated cardiomyopathy and ICD therapy may be the ultimate and definitive treatment for these patients. In this patient, there was no inducible bundle branch re-entry VT detected in the electrophysiology study.

There is increasing evidence that biventricular pacing may be an effective form of non-pharmacological therapy for selected patients with dilated cardiomyopathy. It is quite common for these patients with dilated cardiomyopathy to have evidence of intraventricular conduction delay (IVCD) manifested as LBBB pattern on ECG. Mechanical dyssynchrony owing to IVCD may account for worse prognosis in this selected group of patients. With simultaneous left and right ventricular pacing, resynchronization of LV contraction could improve the symptoms and functional capacity of these patients in one study. LV pacing lead is usually positioned in the branch of coronary sinus.
Combined biventricular pacing and ICD therapy in one single device, called biventricular ICD, is recently available and has been implanted to our patient. The ECG findings with different pacing modes were shown in Figures 3-5. There was modest narrowing of QRS complex with biventricular pacing when compared to baseline ECG. It is worth noting that there was marked axis shifting with different pacing modes. The axis change in ECG with LV or biventricular pacing is sometimes difficult to predict as it depends on the position of the LV pacing lead in the vein branch of coronary sinus and its relative spatial relationship with the RV pacing lead. The underlying reason is that the LV pacing lead is an unipolar lead and requires the anode of the bipolar RV pacing lead to complete the circuit. This complicated pacing system could give rise to the indeterminate axis in ECG with biventricular pacing, as in Figure 5.

In summary, biventricular ICD is one of the therapeutic options in patients with indications for both ICD and biventricular pacing therapy. The ECG findings in patients implanted with this device may show narrowing of QRS complex together with marked change in QRS axis.

References