



The ECG shows a wide QRS-complex tachycardia at 156bpm.

Before discussing the best management option, the exact diagnosis is needed.

The differential diagnosis that must be considered includes:

1. Ventricular tachycardia (VT)
2. Supraventricular tachycardia (SVT) changing to another rhythm
3. Atrial fibrillation in WPW with pre-excited QRS complexes
4. Atrial fibrillation with right bundle branch block and rapid ventricular rate
5. Atrial flutter with varying AV conduction

## OBSERVATIONS

Systematic analysis reveals (standard calibration):

### Rate

In this standard 10-second 12-lead ECG recording, there are 26 QRS complexes, giving a heart rate of 156bpm.

### Rhythm

The rhythm is not regular. At the beginning, one may get the impression of regularity with a rate of around 188bpm. In the second half of the ECG, the irregularity is obvious. Very careful measurement of the first part shows that this too is not entirely regular, with variation of R-R interval as little as 20-40ms.

### QRS width

All the QRS complexes are wide and similar in morphology (as seen in the bottom VI rhythm strip). Width = 120ms. (Normal is up to 100ms or 2.5 little blocks.)

### QRS axis

Approximately  $0^\circ$  (normal in adult is  $-30$  to  $+90^\circ$ ).

QRS morphology: In V1: rsR' pattern. In V6, a qRs pattern with a normal skinny q wave, also seen in Lead I, and representing rapid septal depolarization.

The s wave in V6 is shallow and broad / slurred. All these findings are typical of Right Bundle Branch Block (RBBB).

### P waves

The question is: are there any? In the rhythm strip, at slower rates, there does appear to be something that looks like a P wave in front of some of the QRSs but this is not a consistent finding. The last long R-R interval in aVL shows a number of waves of atrial activity that are not regular and variable. Hence, although there is atrial activity, there are no obvious regular P waves.

## DIAGNOSIS AND DISCUSSION

These observations:

1. Exclude VT because the rhythm is very irregular and the QRSs are typical of RBBB with normal axis. (Therefore, answer "b" is incorrect.)
2. Are compatible with underlying atrial fibrillation because of the irregular rhythm in the absence of regular organized atrial activity.
3. Exclude an SVT in the first half of the ECG because even in this part the R-R intervals are not entirely regular and the change to more irregularity did not follow some vagal manoeuvre. (Not answer "d".)
4. Exclude atrial flutter because the approximate rate in the first half is 190bpm which is too slow for 1:1 AV conduction of atrial flutter and too slow for 2:1 which typically gives a ventricular rate of approximately 150bpm. (Not answer "e".)
5. Exclude pre-excitation of the QRS complex as would occur with an accessory pathway in WPW because the initial part of each QRS

complex shows rapid conduction, whereas in pre-excitation this would be slow. (Not answer "c".)

Therefore, this is atrial fibrillation with very rapid ventricular response and underlying RBBB. Of note is that atrial fibrillation may appear to regularize at rapid conduction rates.

### **TREATMENT AND MANAGEMENT OPTIONS**

This patient with a past history of hypertension presented with evidence of heart failure, but without hemodynamic compromise and with palpitations for > 24-48 hours. Whenever one sees atrial fibrillation with rapid ventricular response, the treatment is aimed not at the arrhythmia but at the underlying condition that is causing the rapid ventricular response. Unless this condition is corrected, trying to eliminate the AFib by e.g. cardioversion is misguided because it is likely that the AFib will just recur. (Additionally, in this patient, cardioversion is actually contra-indicated because of the 3-day duration of his symptoms, presumably AFib, and the risk of thromboembolism.) The usual cause of the rapid ventricular response is not a change in the AFib in the atria but a catecholamine effect on the AV node facilitating conduction of atrial impulses to the ventricles. This may occur with sepsis, hypoxia, hypovolemia, fever; in this case, the increased AV conduction is due to heart failure. This is where the primary treatment is aimed. Hence, diuretics and possibly nitrates should be given first. As the heart failure is brought under control, the ventricular rate will decrease and sometimes this catecholamine withdrawal may be associated with a spontaneous reversion of the AFib to sinus rhythm. As he has had recurrent episodes, he needs to be considered for warfarin.

### **CONCLUSION**

The default diagnosis in any irregular tachycardia, whether the QRS complexes are narrow or wide, is atrial fibrillation.

In atrial fibrillation with rapid ventricular response, the treatment is not directed at the atrial fibrillation but at the underlying clinical condition that is promoting the rapid rates.

The management of this patient is treatment of his heart failure and subsequent management of his atrial fibrillation (answer "a").