

Mahaim Fiber mediated Atrio-Ventricular Re-entrant Tachycardia (AVRT)

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Case Report:

A 20 year old female was referred, from another centre, with a five year history of SVT. She was having palpitations about twice per week lasting 10-15 minutes. The longest episode she experienced lasted 3-4 hours, at that time she was admitted to hospital and was given adenosine which cardioverted her to sinus rhythm. She was commenced on Atenolol 25 mgs prior to discharge.

She was otherwise healthy her physical examination was normal. Heart structure and function were found to be normal on Transthoracic Echocardiogram. ECG (Figure 1) showed normal sinus rhythm with normal PR and QT intervals.

An event monitor was performed. There were no documented episodes of SVT; however, intermittent partial pre-excitation was observed (Figure 2).

The patient was scheduled for Electrophysiology (EP) study and ablation.

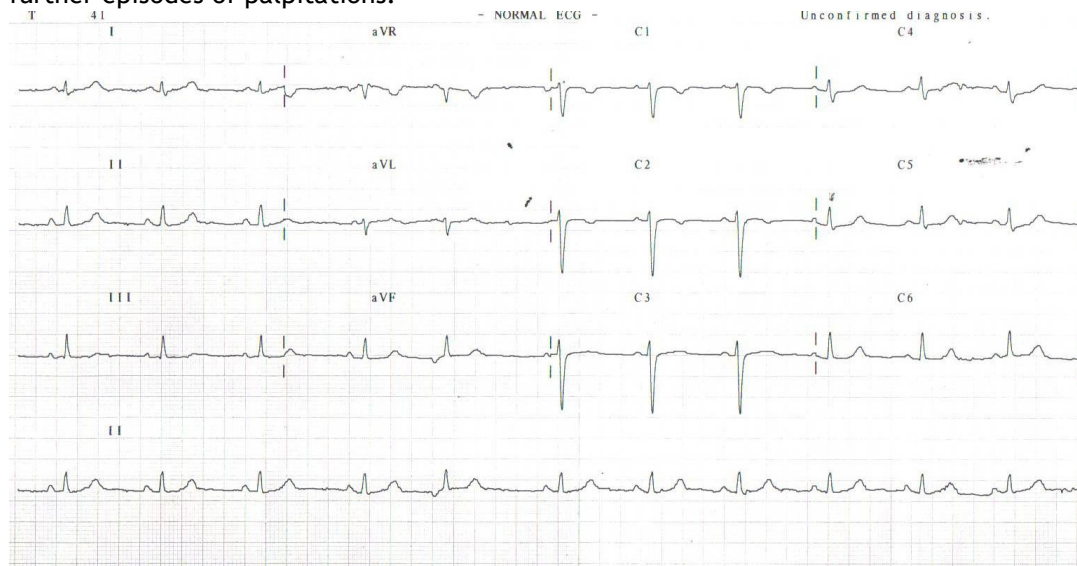
During EP study intermittent pre-excitation was observed with left bundle branch block (LBBB) morphology, the point of earliest ventricular activation during pre-excited beats and during tachycardia was the right ventricular apex (Figure 5).

The bypass tract demonstrated decremental conduction properties and dual AV nodal pathway physiology was also demonstrated.

Isoprenaline infusion at 2mcgs/kg/min was used to induce sustained tachycardia. Tachycardia cycle length was 335mSec, was wide complex with LBBB morphology. (Figure 3)

A diagnosis of Mahaim Fibre mediated antidromic tachycardia was made. Following mapping of the tricuspid annulus a mahaim potential was recorded and following delivery of 3 radiofrequency lesions was successfully ablated.

The patient was discharged home the following day off beta-blockers. She was reviewed in the Out Patients Clinic at 2 and 6 month intervals post procedure, she continued to do well with no further episodes of palpitations.



• Figure 1: Resting ECG showing sinus rhythm and normal PR and QT intervals



• **Figure 2: Event monitor strip showing intermittent partial pre-excitation (Arrows)**

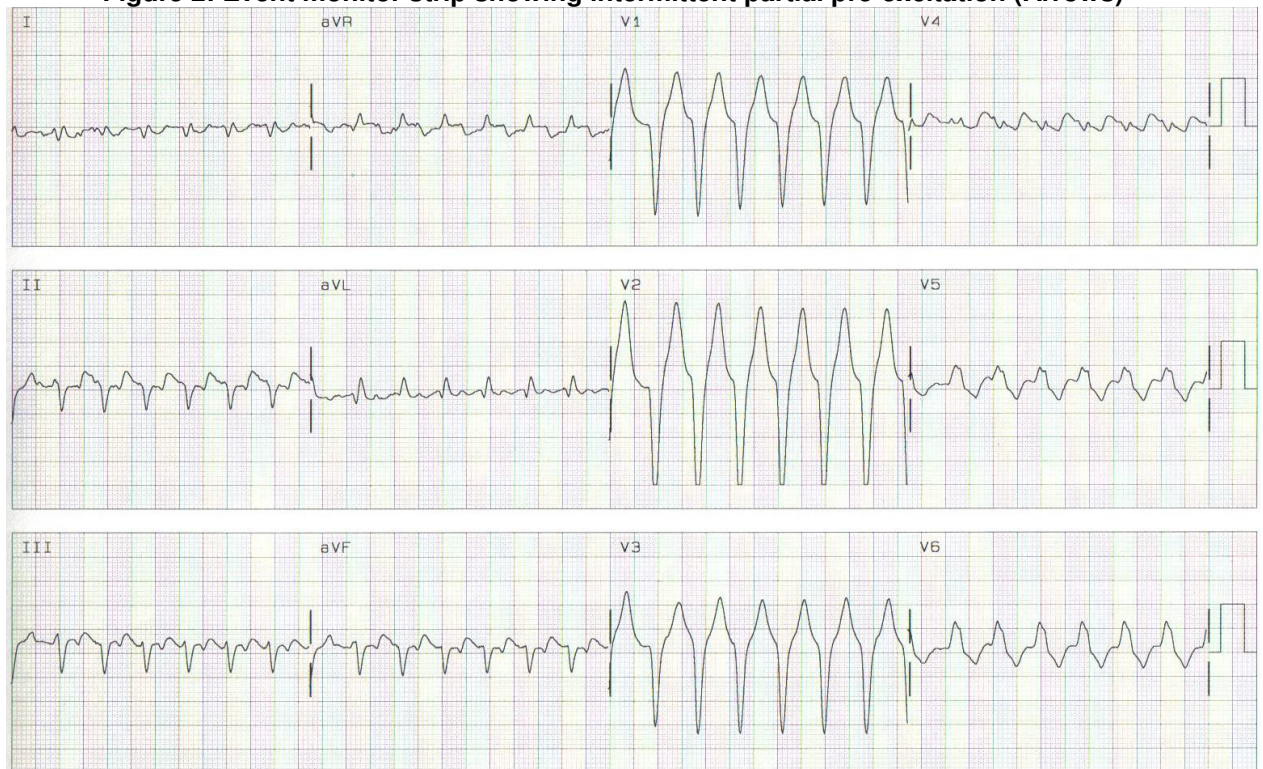


Figure 3: 12 Lead ECG during tachycardia demonstrating wide complex tachycardia with LBBB morphology

Discussion:

Mahaim Fibres are unusual accessory pathways, which account for 3-5.9% of accessory pathways. They can be characterised into two types:

- Atriofascicular connections: account for approximately 80% of mahaim fibres they have a long intracardiac course and insert into the distal right bundle branch or right ventricle near the apex
- Atrioventricular connections run between atrial tissue and ventricular muscle and account for the remaining 20%.

The usual arrhythmia is an atrio-ventricular re-entrant tachycardia (AVRT) with anterograde conduction via the accessory pathway and retrograde conduction via the AV node. (Figure 4) As RBBB pre-excitation occurs during tachycardia it will display LBBB morphology.

Although mahaim fibres are anatomically distinct from the AV node, they are electrophysiologically similar.

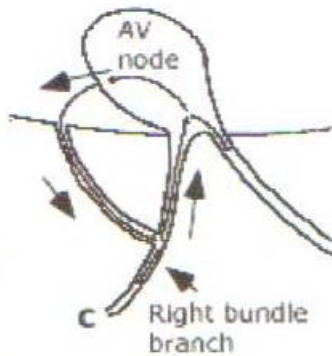


Figure 4: Diagram of the mechanism of mahaim fibre mediated tachycardia circuit. The Mahaim fibre acts as the anterograde limb and the AV node as the retrograde limb

Electrophysiological features of Atriofascicular Mahaim fibres:

- The resting ECG is usually normal as conduction tends to be preferentially over the AV node at resting heart rates. A delta wave is not seen in Mahaim fiber conduction as the pathway terminates in or near the conduction system.
- These fibres exhibit the kind of decremental properties seen in AV nodal tissue.i.e. Conduction along them slows at faster heart rates.
- They are also responsive to adenosine.
- Retrograde conduction is absent in atriofascicular fibres. Therefore, tachycardias mediated by these tracts will be antidromic i.e. using the bypass tract in the antegrade direction and AV node retrograde. Tachycardia , or fast atrial pacing, will also yield left bundle branch morphology
- During pre-excitation, earliest ventricular activation is seen in the apex of the right ventricle as the right bundle branch is being pre-excited.(Figure 5)

Electrophysiological features of Atrioventricular Mahaim fibres:

- Display the same features as Atriofascicular Mahaim fibres, with the exception that the RV apex is not the earliest site of ventricular activation during pre-excitation.

Other conditions associated with Mahaim fibres:

In approximately 40% of patients dual AV nodal pathways, (as in the case presented), or other accessory pathways are present. They are also associated with Ebstein's Anomaly of the tricuspid valve.

Treatment Options:

Two treatment options are available; pharmacological or Ablation.

Ablation:

Mapping is performed to identify ablation sites. Because of their conduction and anatomic location, it is difficult to map both the proximal (atrial) and distal (ventricular) insertion points of Mahaim fibres. They do not conduct retrogradely so proximal insertion cannot be identified with ventricular pacing.

In this case the tricuspid annulus was mapped to identify a Mahaim potential i.e. a localised potential from the bypass tract itself. This appears as a relatively low amplitude, sharp potential, lying between the atrial and ventricular EGM's during tachycardia or pre-excited atrial pacing.

Once the ablation site is identified radiofrequency energy is applied. In this case 3 RF lesions were required to successfully ablate the pathway.

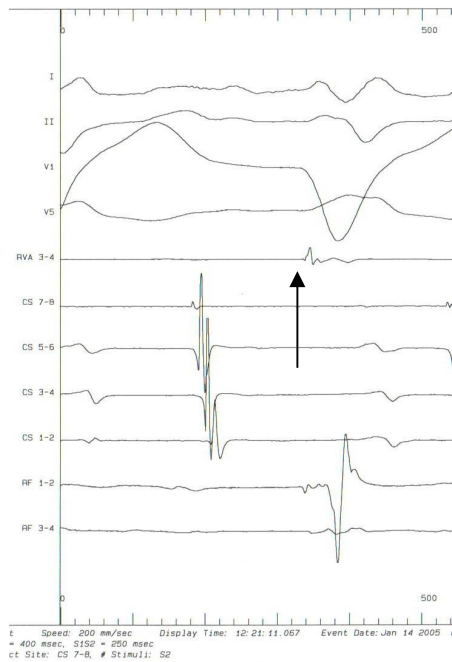


Figure 5 EGM during pre-excitation demonstrating earliest ventricular activation in the RV apex, consistent with an atriofascicular pathway.

References:

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