

Pacemaker ECGs

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Pacemaker ECG

- Artificial Pacemakers generate an electric voltage of generally less than 1 msec - ECG appears unnaturally short and spikey
- Pacer spike can be in atrium or ventricle or both.
- Capture: pacer spike precedes a P or a QRS
- Sense: no pacer spike shortly after a P or a QRS

Pacemaker Features that Cause Confusion in ECG Interpretation

- Rate-responsive pacing
- Ventricular safety pacing
- Ventricular auto-pacing (?)
- Other interesting features, including response to PVC and intentional firing in QRS
- Prior “committed” AV sequential pacing
- Magnet response signals

Pacemaker ECG



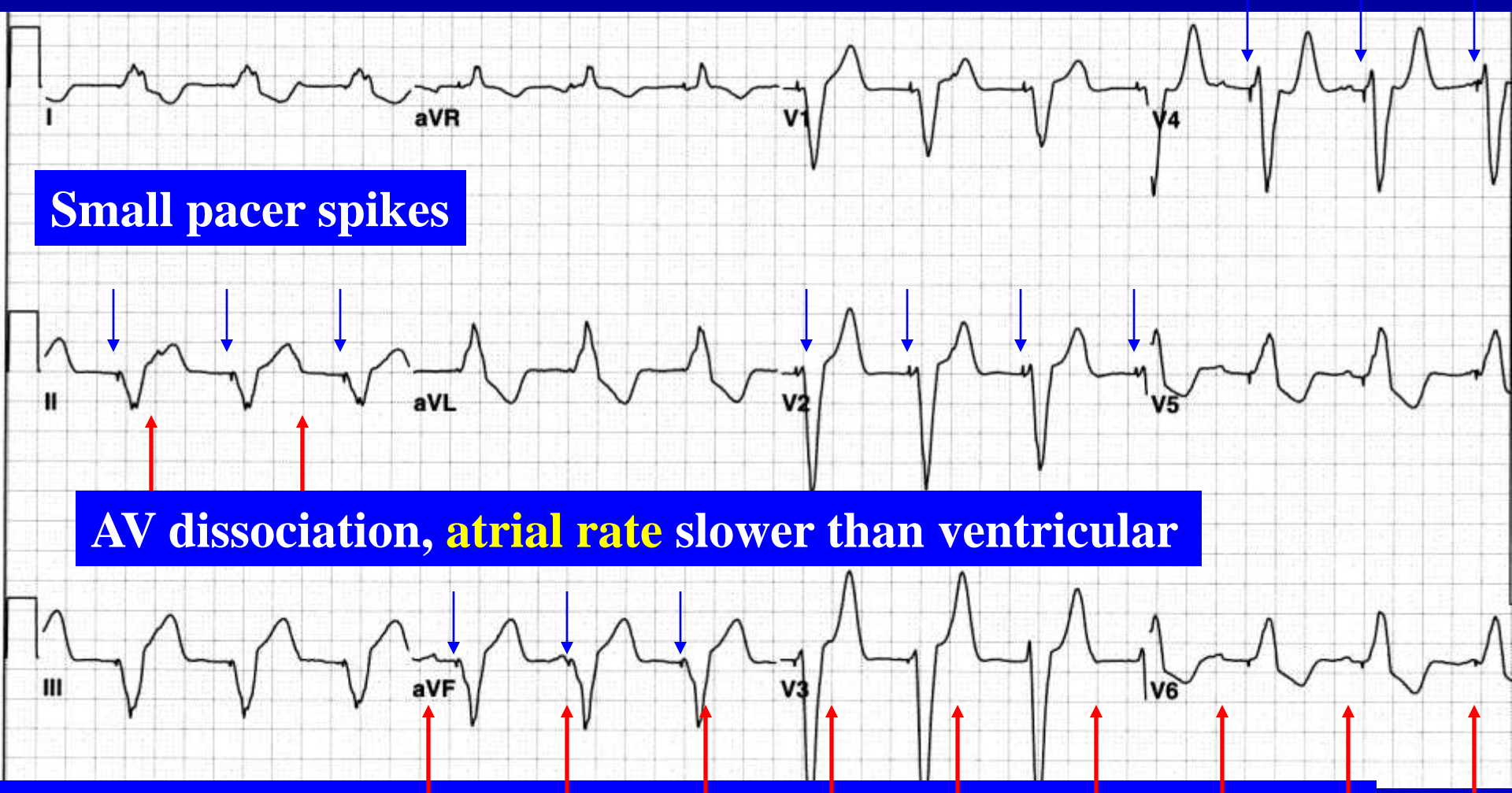
Pacemaker ECG

Variable S1 intensity

Small pacer spikes

AV dissociation, **atrial rate** slower than ventricular

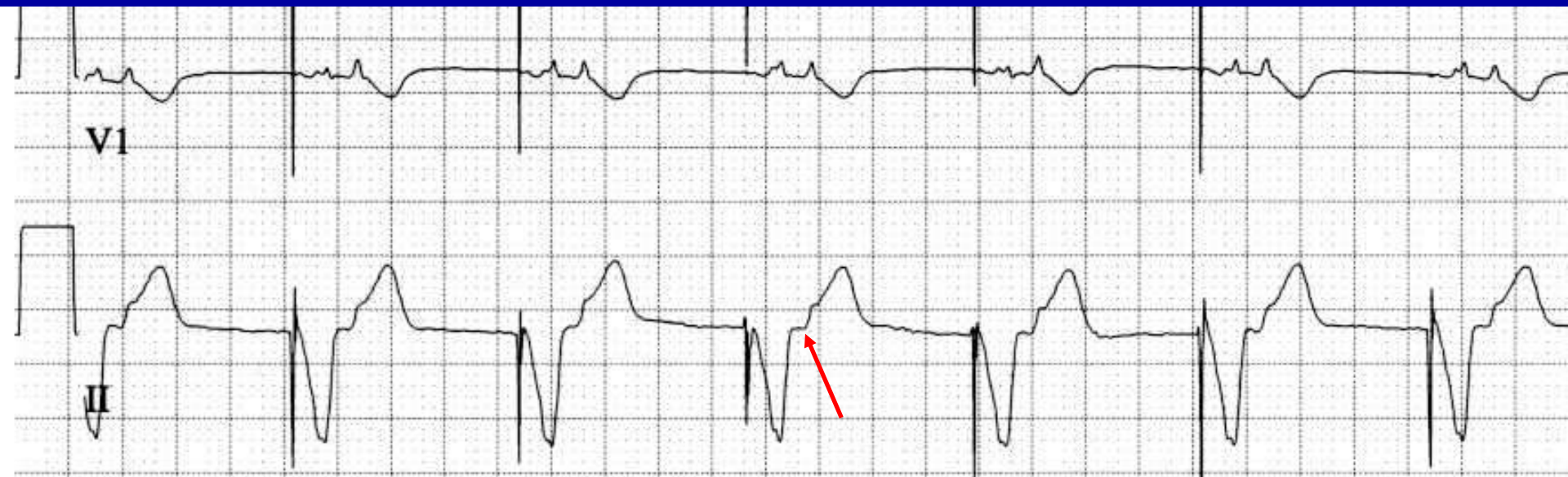
LBBB and left axis deviation is typical pattern for transvenous pacemaker tip at RV apex



Pacemaker ECG



Pacemaker ECG



Note:

Spike before each QRS

No P before any QRS

Hidden P at end of QRS, best seen in II

**Ventricular pacemaker, 100% capture, with
1:1 retrograde conduction (VA conduction)**

Pacemaker ECG



Pacemaker ECG



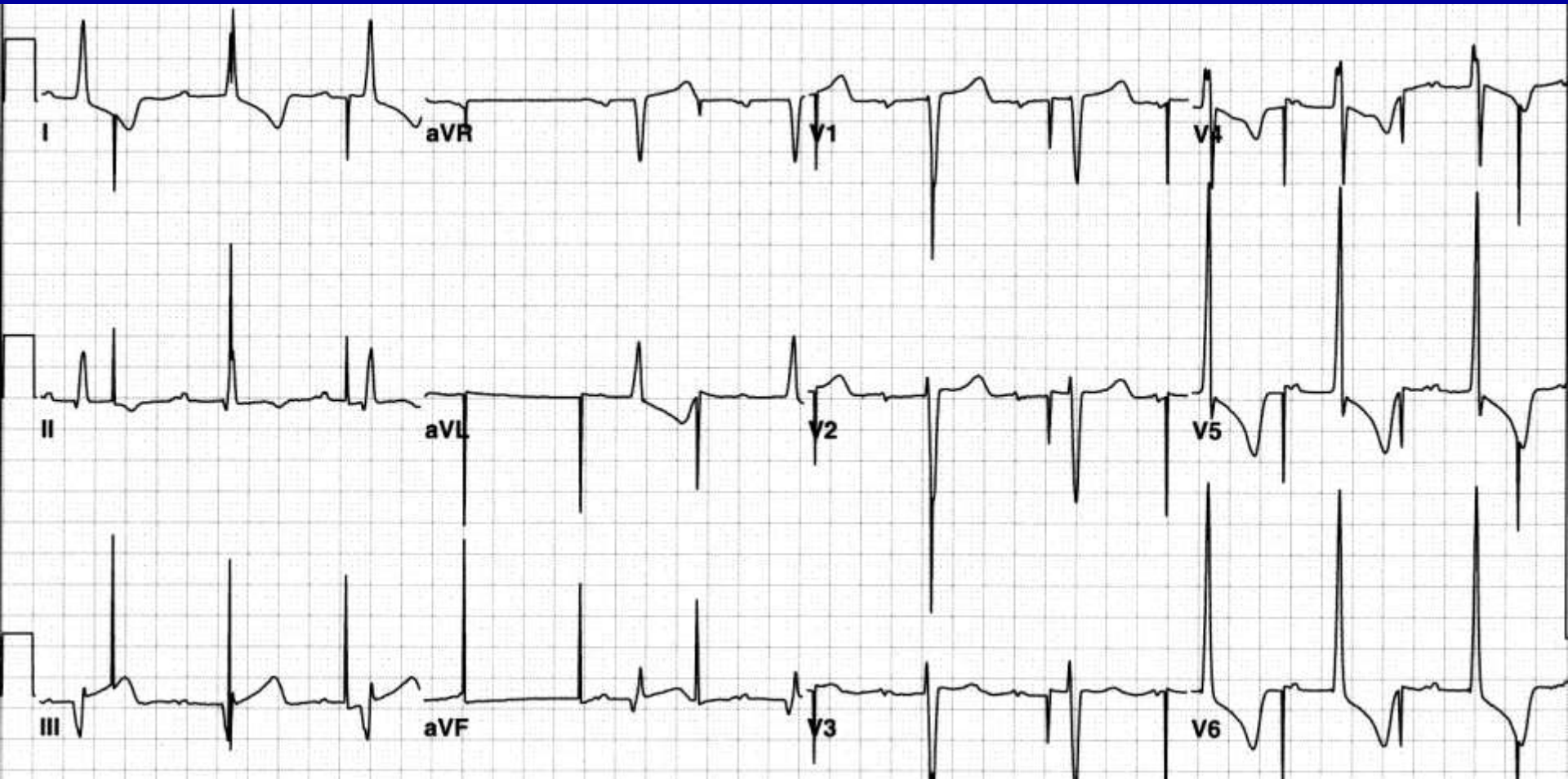
Note:

All QRS initiated by large pacer spike except the last.

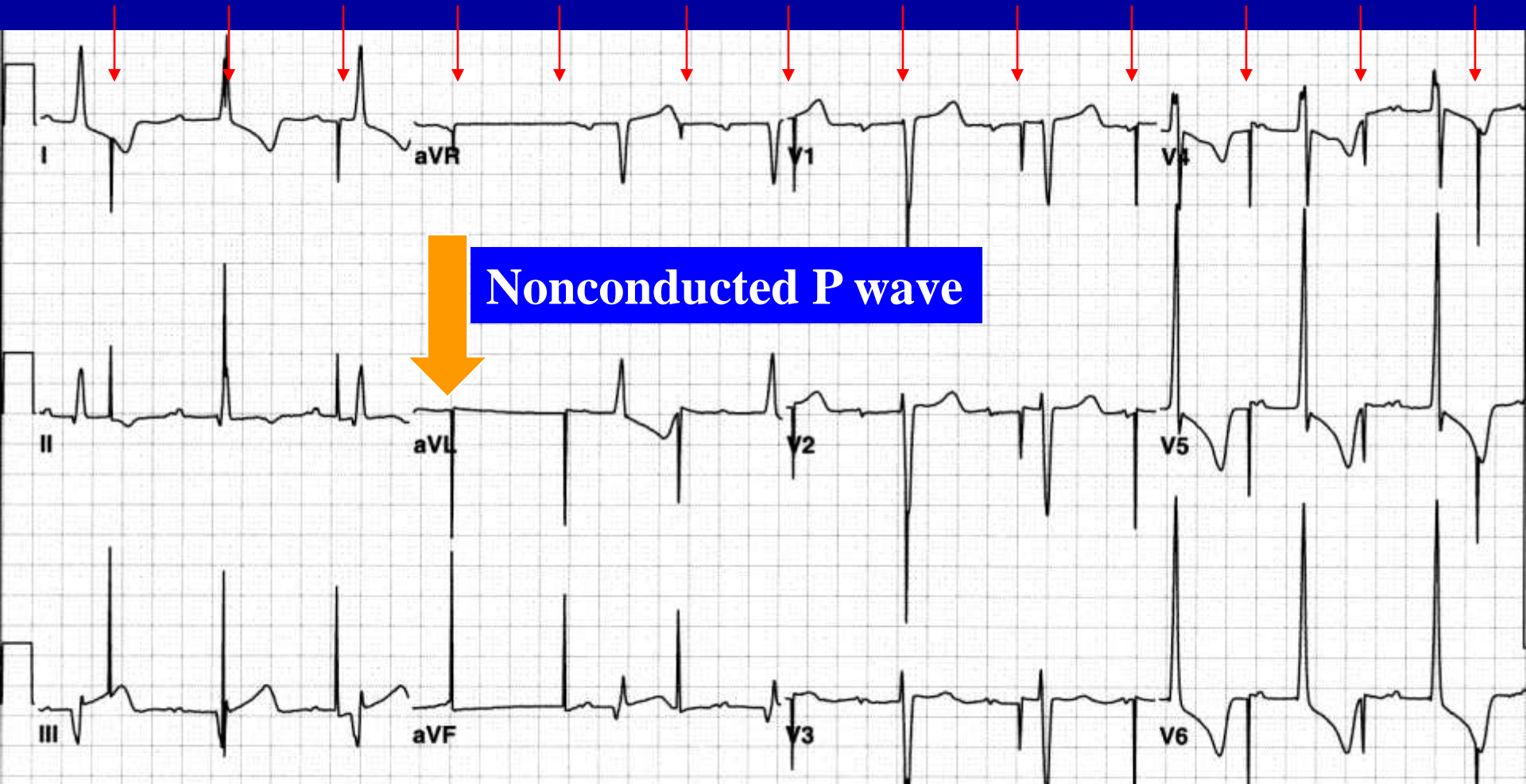
Last paced beat is a fusion beat.

Red arrows show P waves

Pacemaker ECG

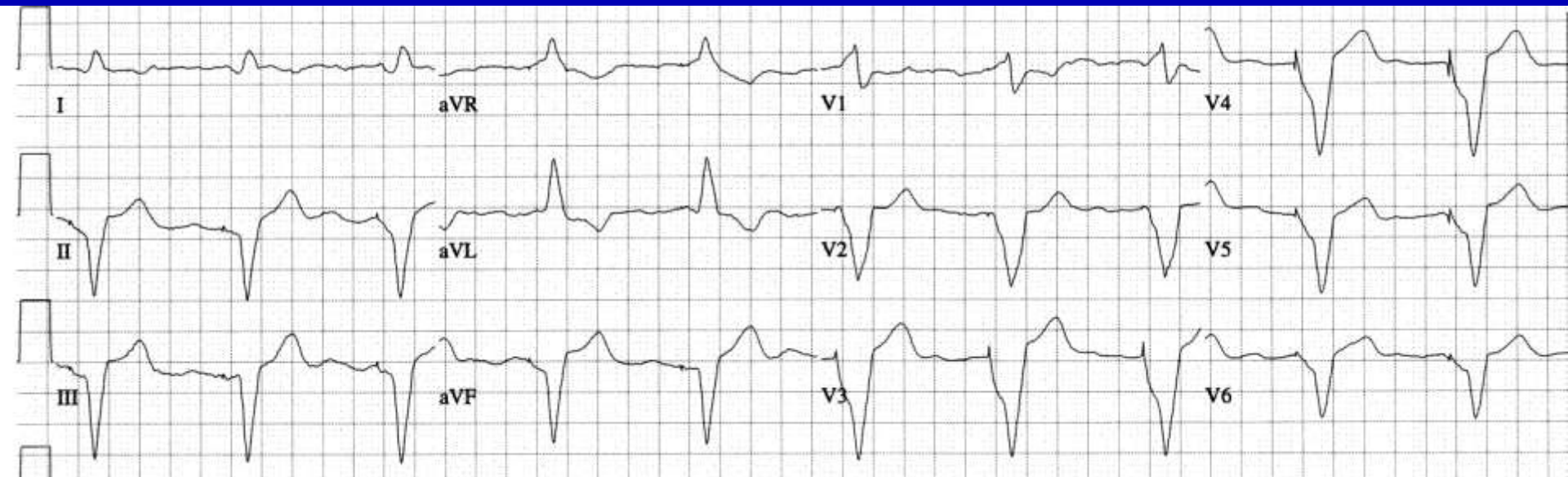
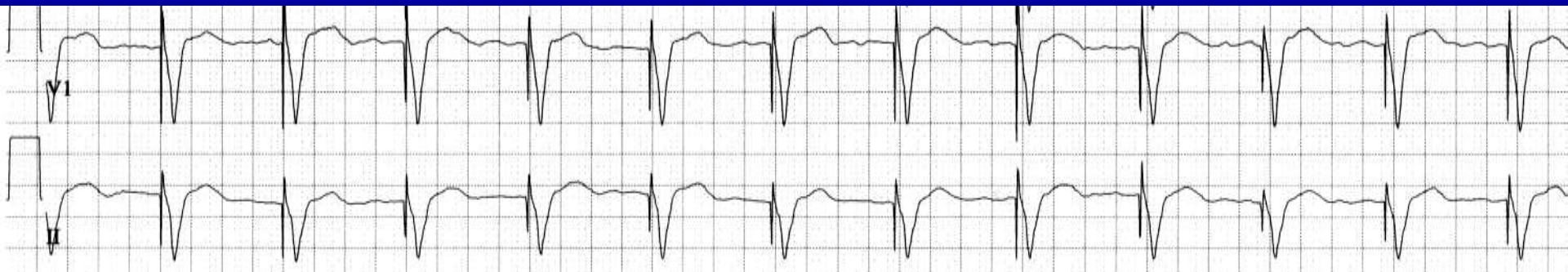


Pacemaker ECG

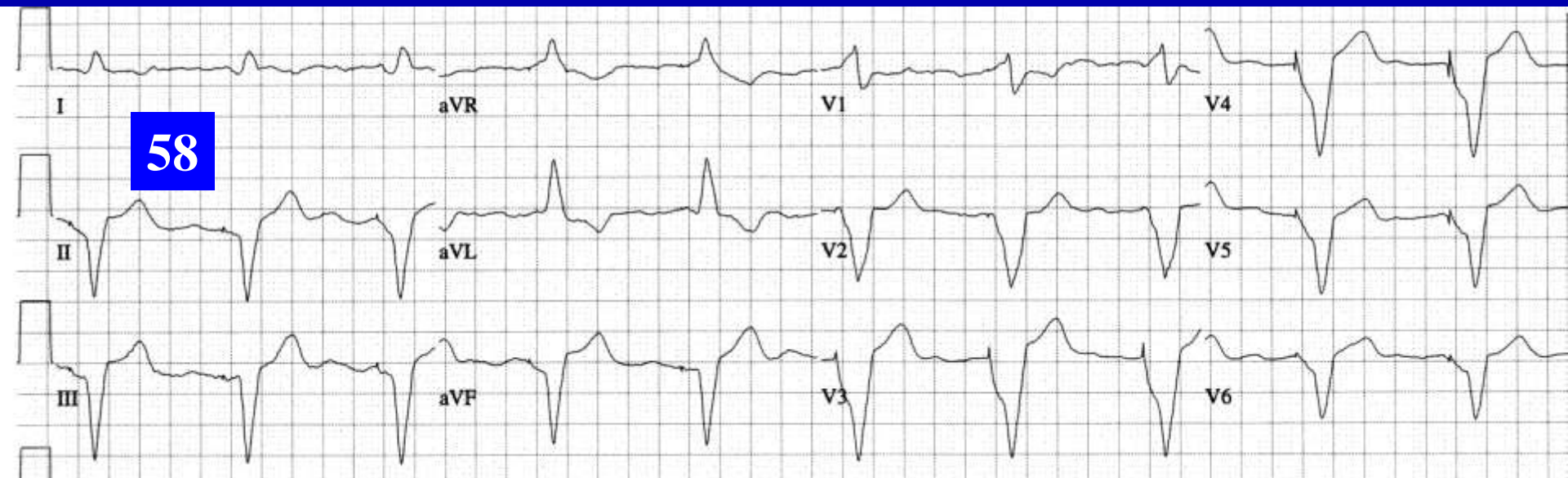
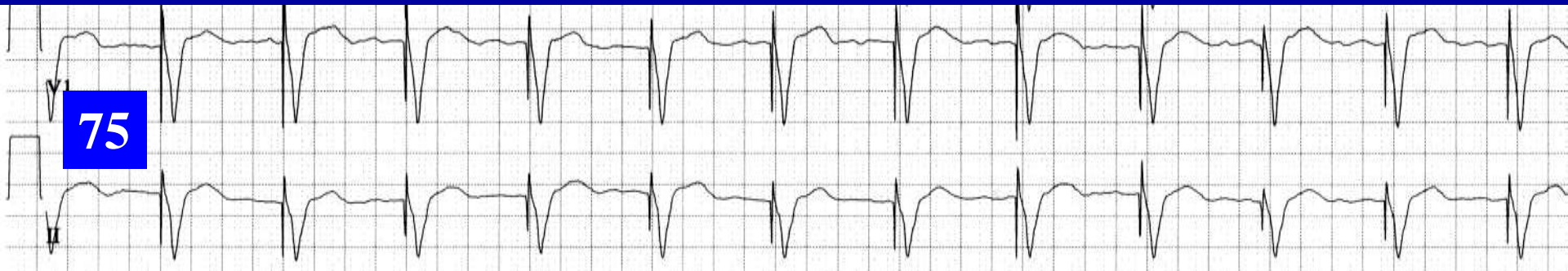


Note: Pacer spikes aren't suppressed by QRS or P waves
Pacer spikes aren't followed by QRS or P waves
Native: NSR rate 65, FAV, IMI recent LVH, Wenckebach

Pacemaker ECG

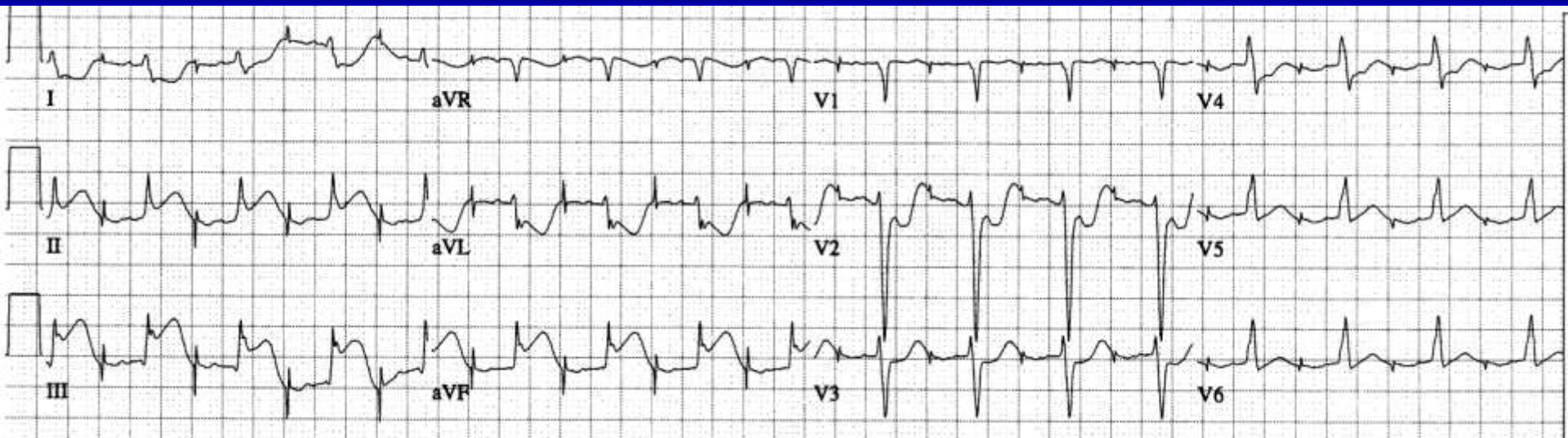


Pacemaker ECG

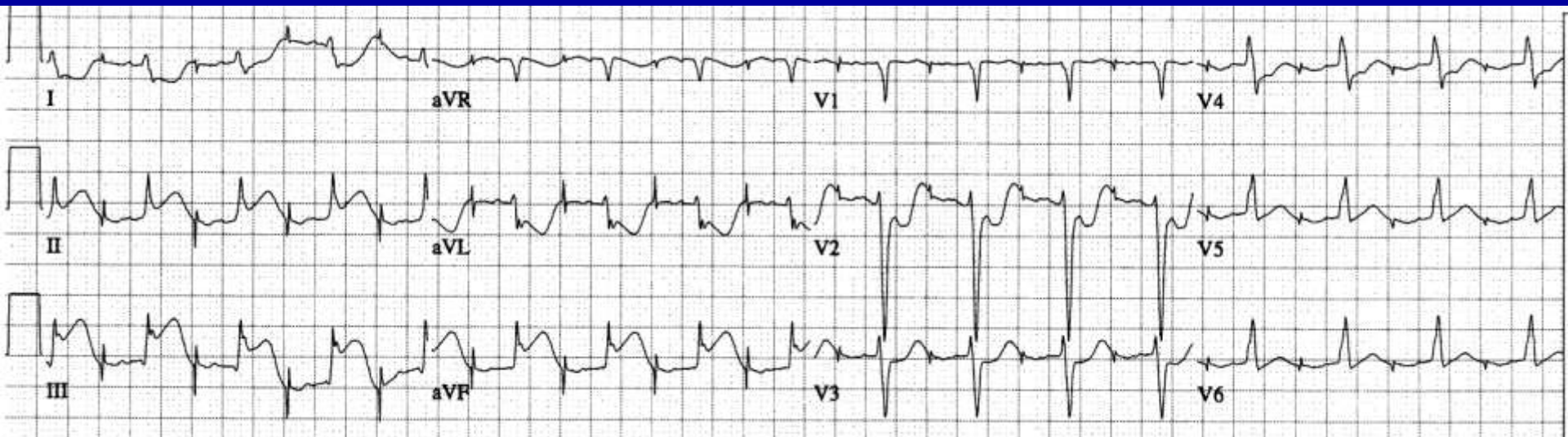


Note: Both patients have atrial fibrillation without AV conduction

Pacemaker ECG



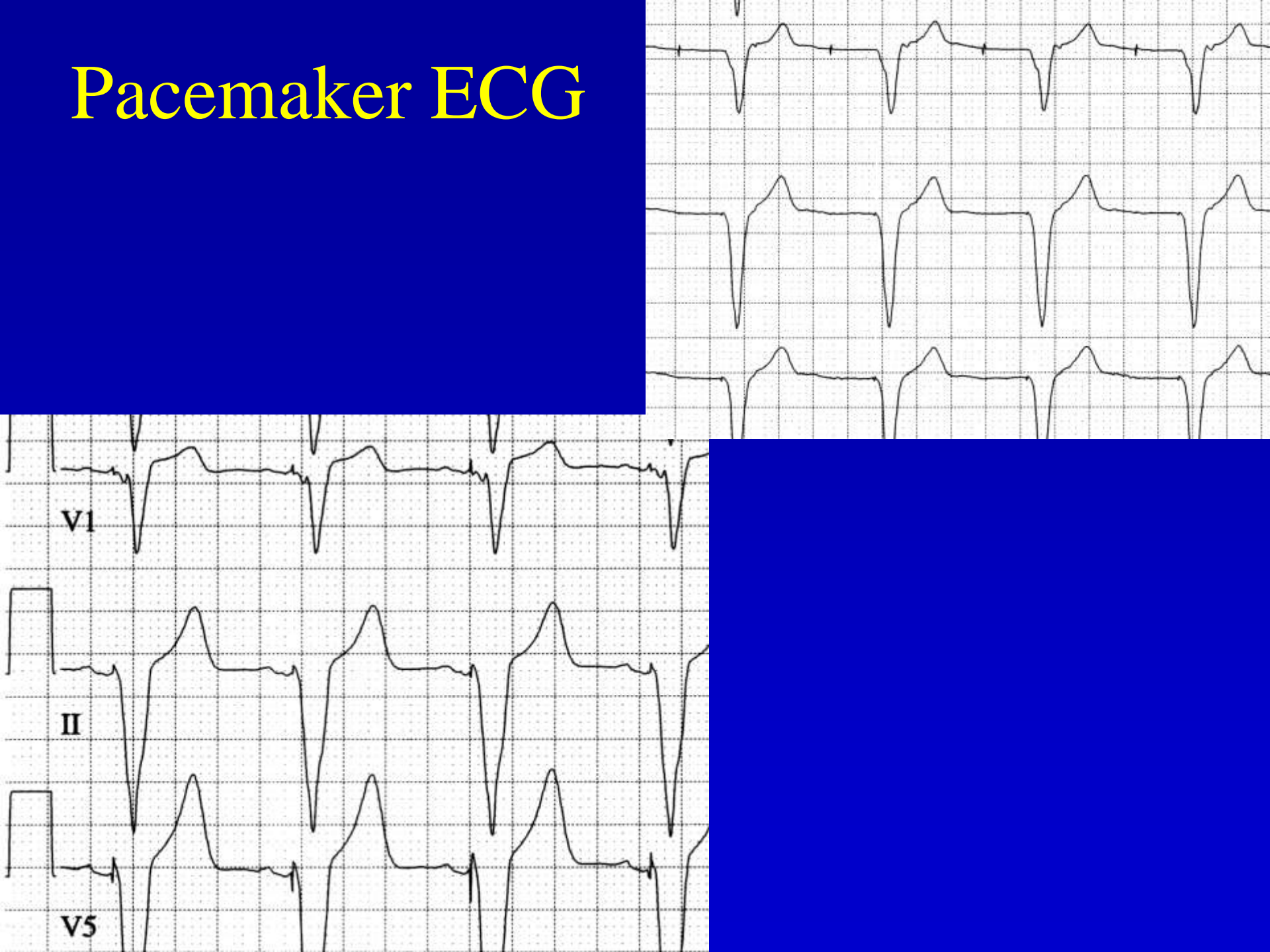
Pacemaker ECG



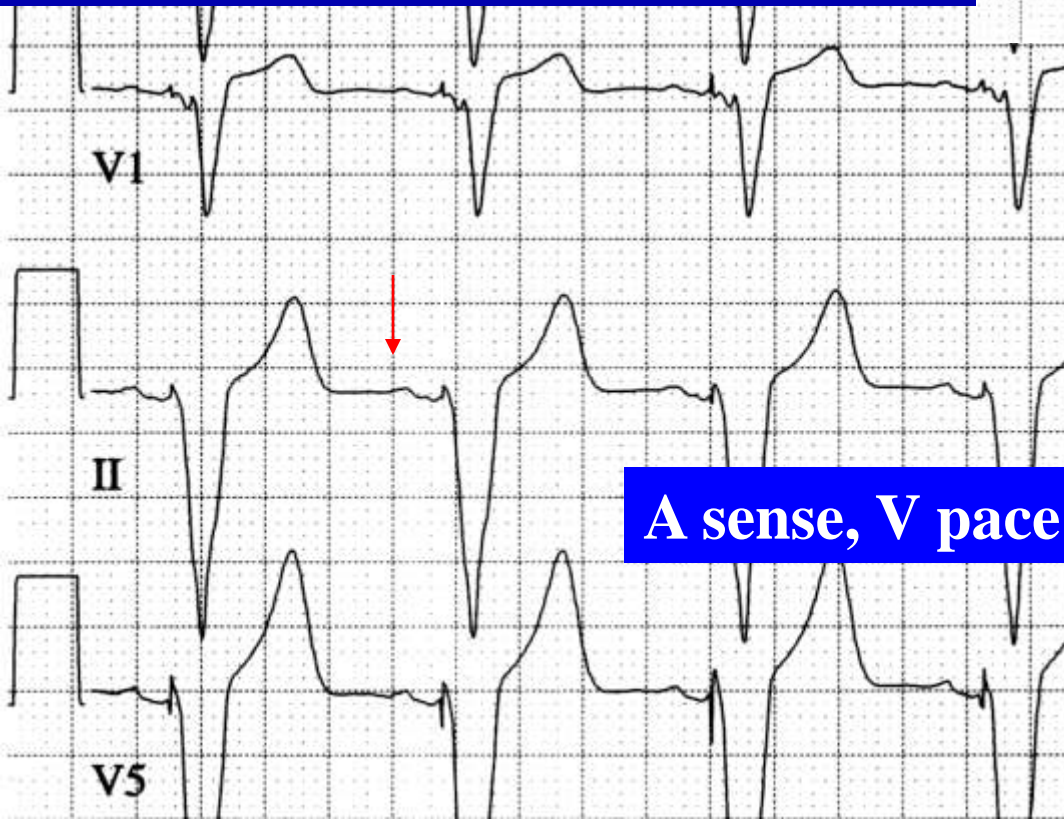
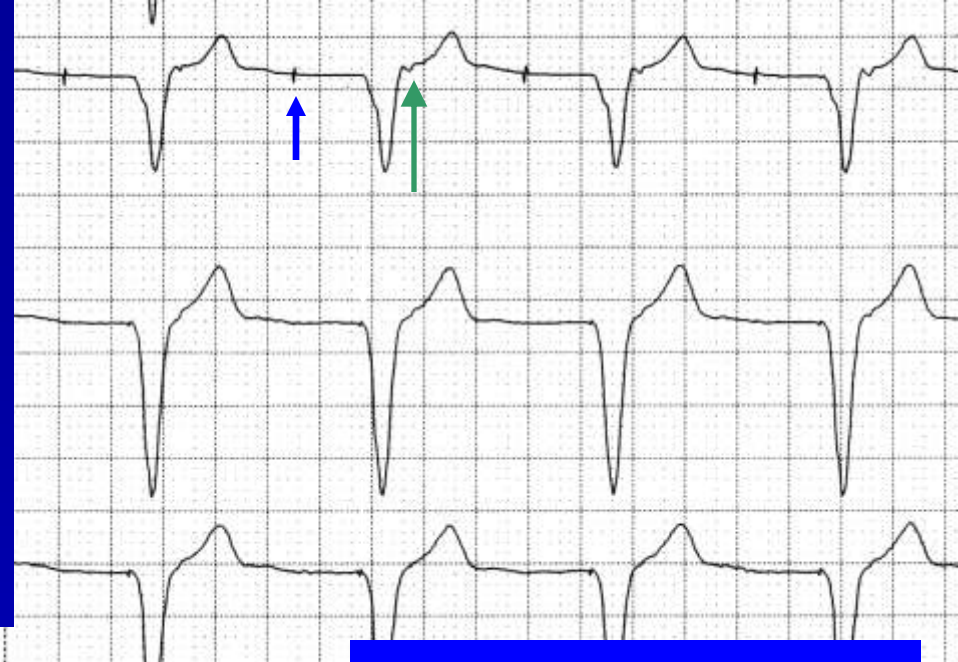
Note:

- Pacer spike followed by P wave - Atrial pacemaker
- Atrial pacer rate is fast at 100 bpm
- Prolonged constant PR interval - First degree AV block
- ST elevation in II, III and F, inferior transmural injury
- Reciprocal change in I and L
- ST depression in V2, posterior injury

Pacemaker ECG



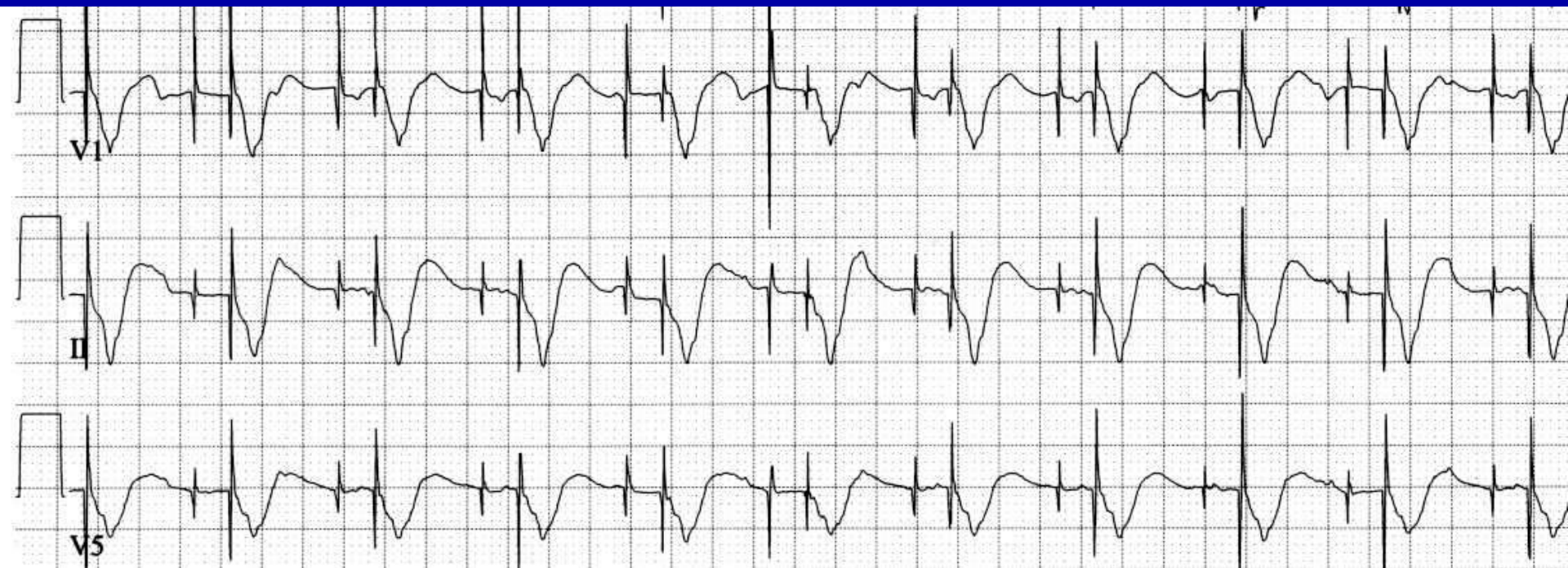
Pacemaker ECG



A pace, noncapture
V pace, capture
retrograde A wave

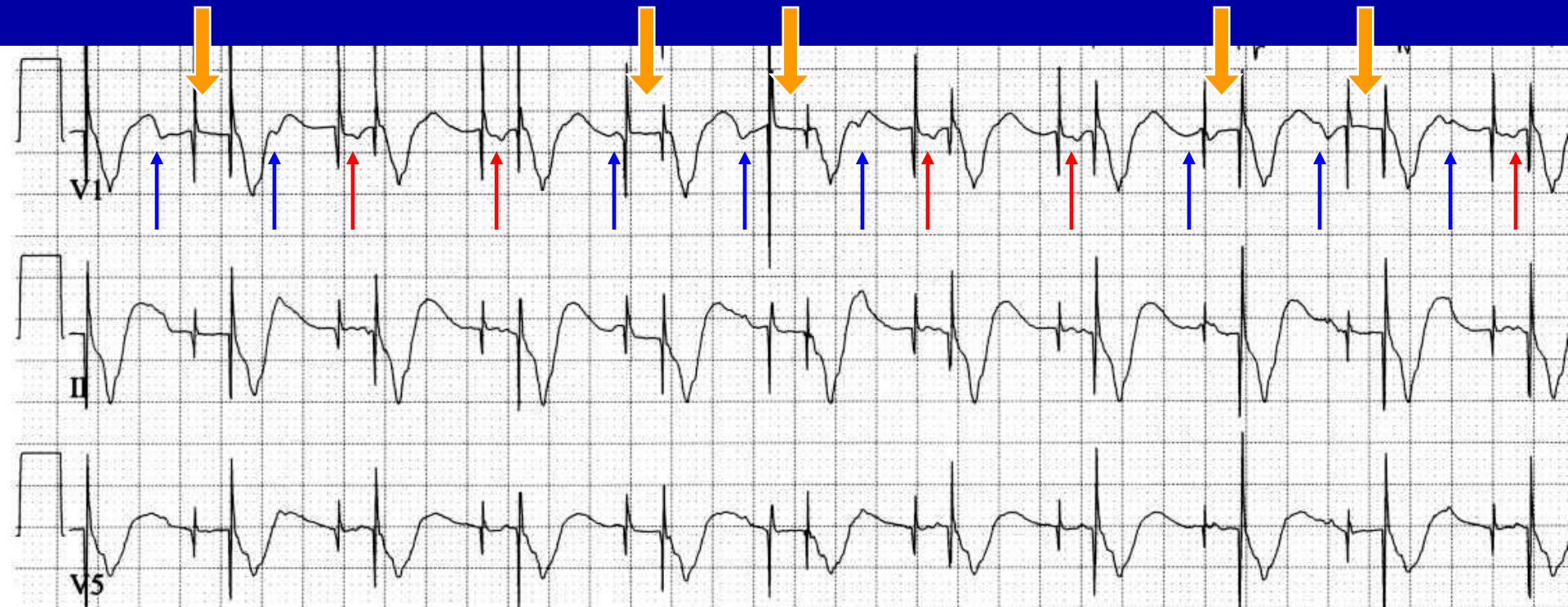
A sense, V pace

Pacemaker ECG



Pacemaker ECG

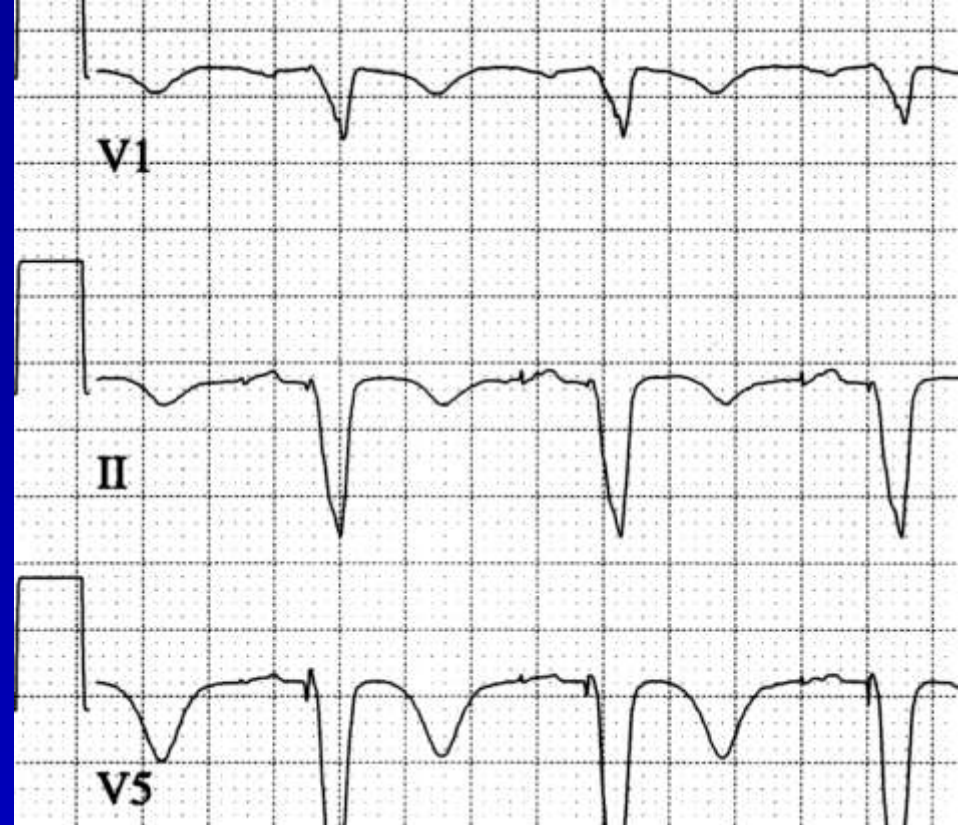
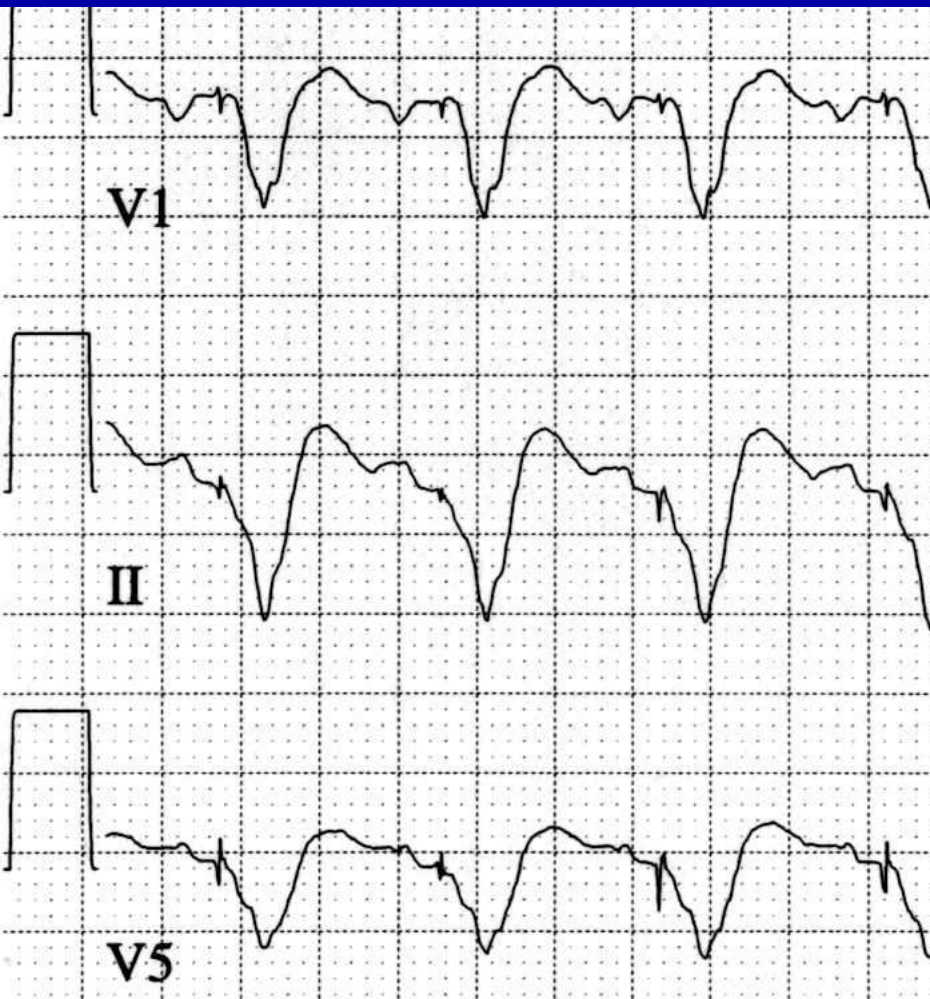
Nonconducted atrial spikes due to refractory atrium



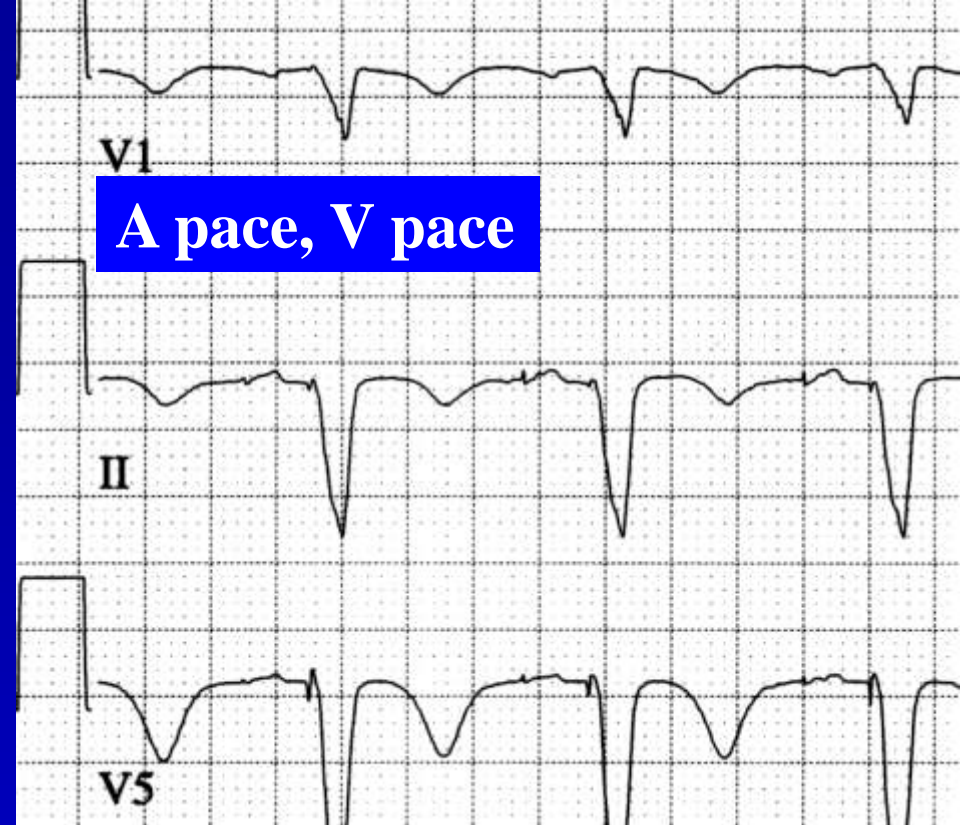
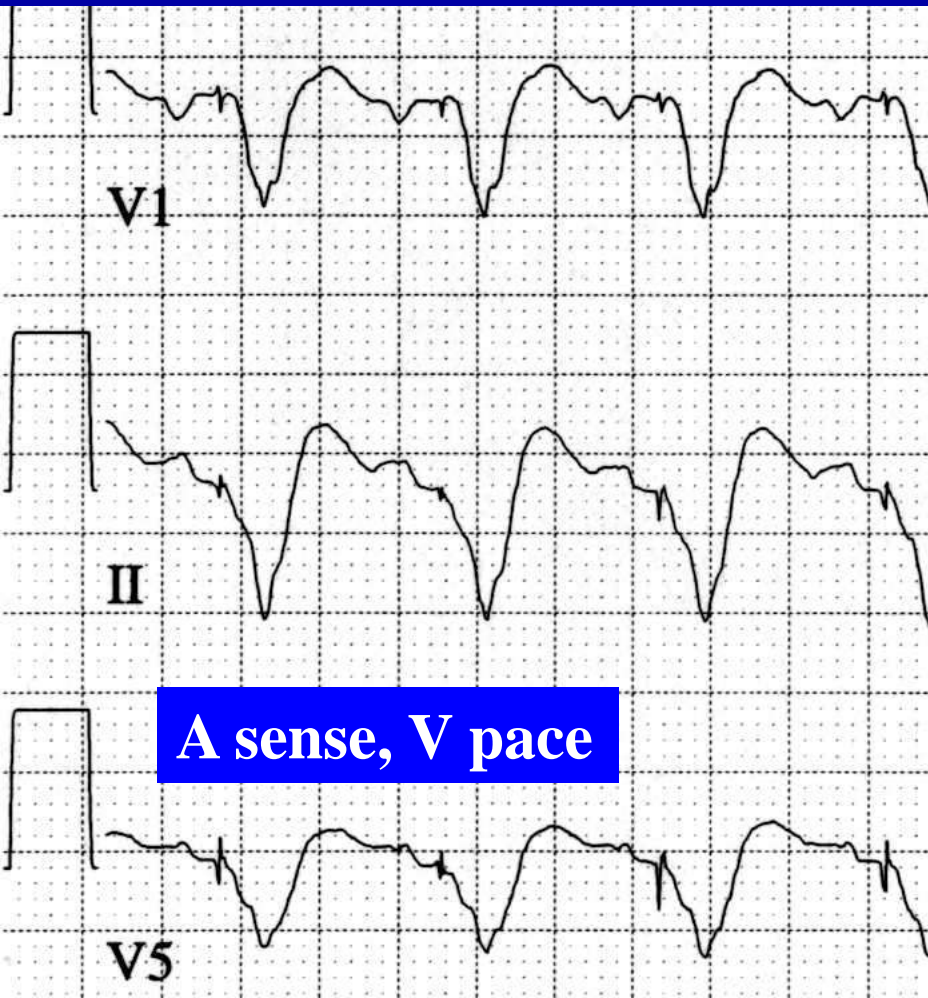
Red arrow - conducted atrial spikes

Blue arrow - native P waves

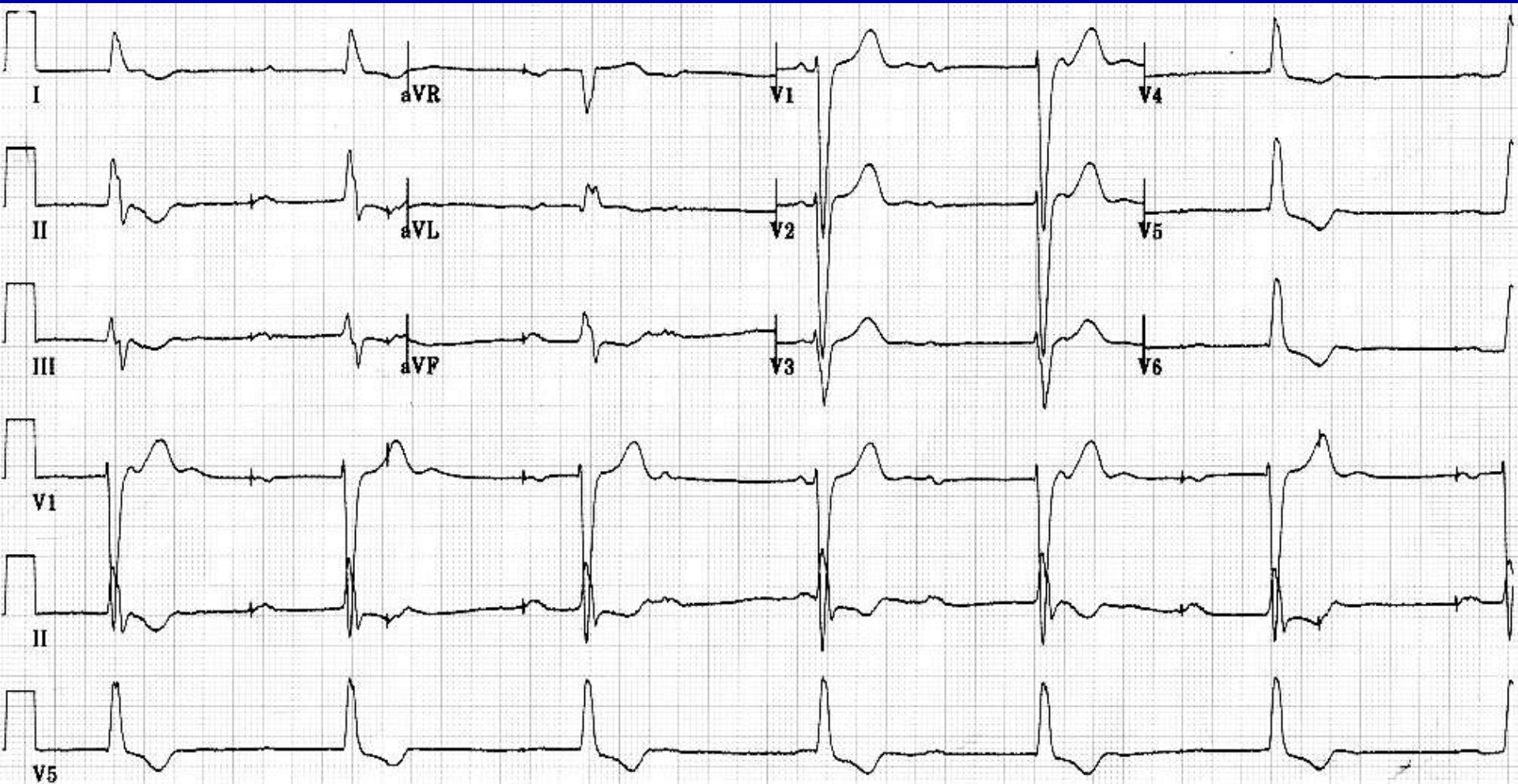
Pacemaker ECG



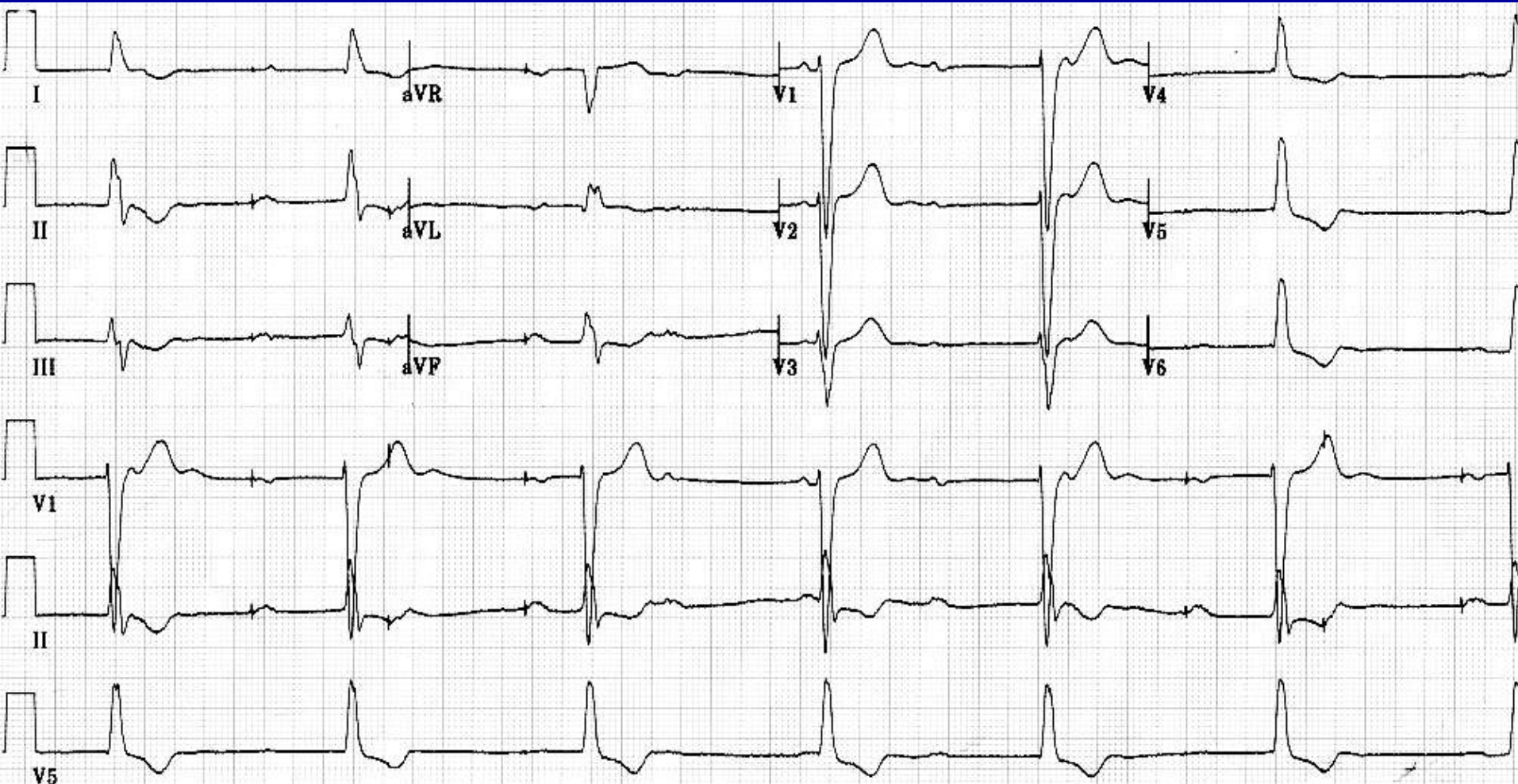
Pacemaker ECG



Case 15

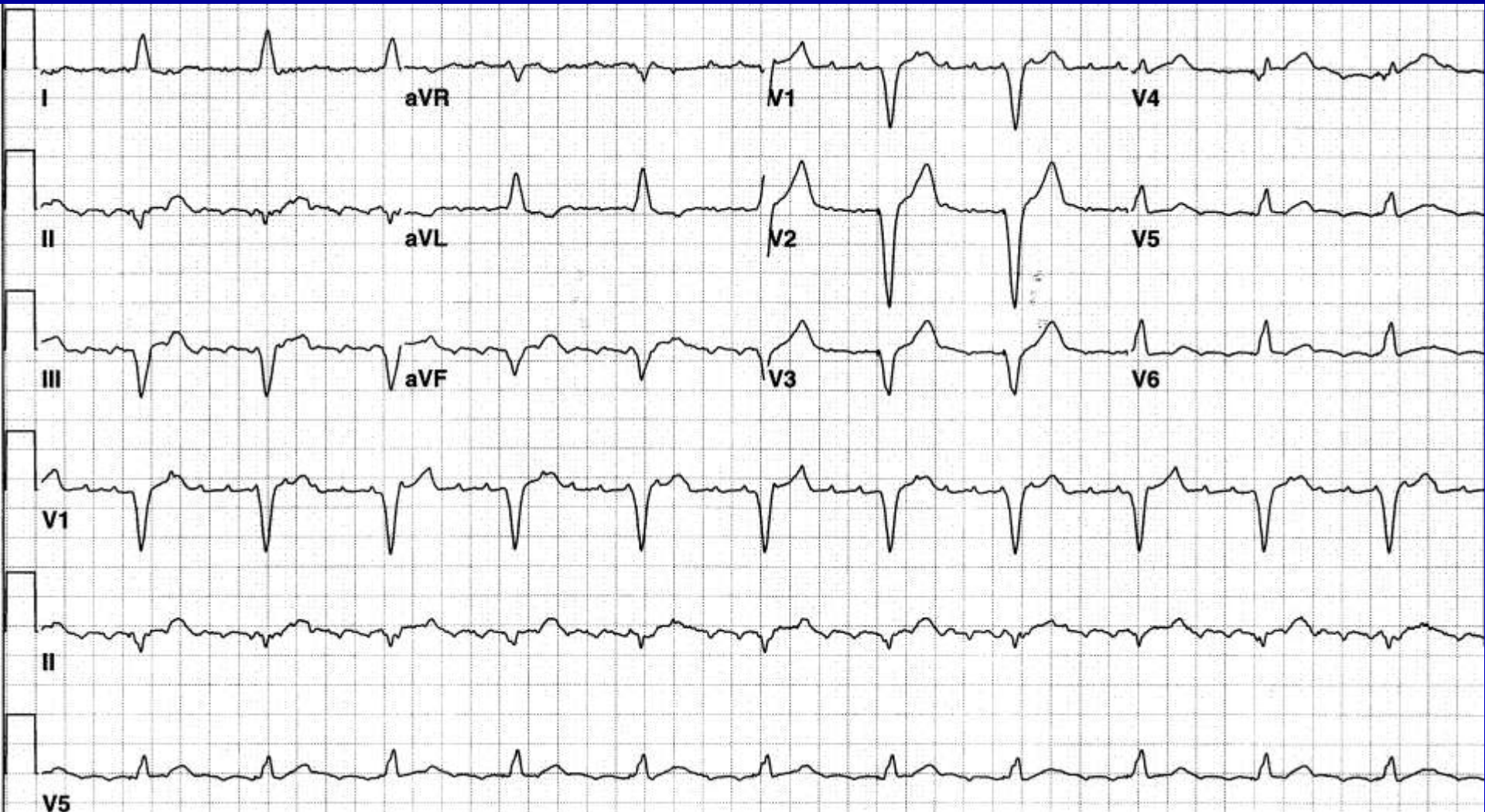


Case 15

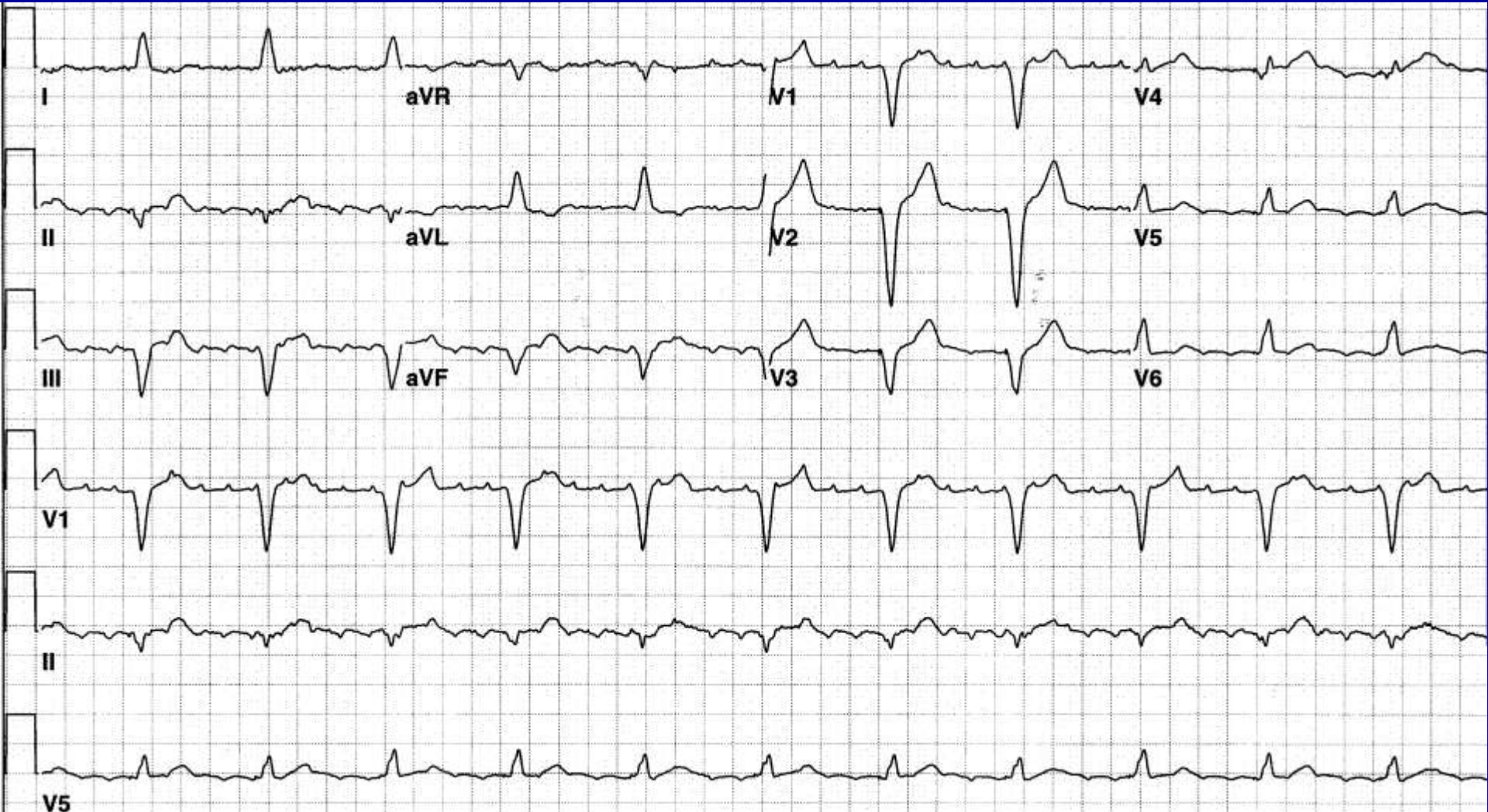


- Complete heart block with ventricular escape rhythm
- Atrial pacemaker with normal sense and capture
- Sinus rhythm rate 65

Case 23

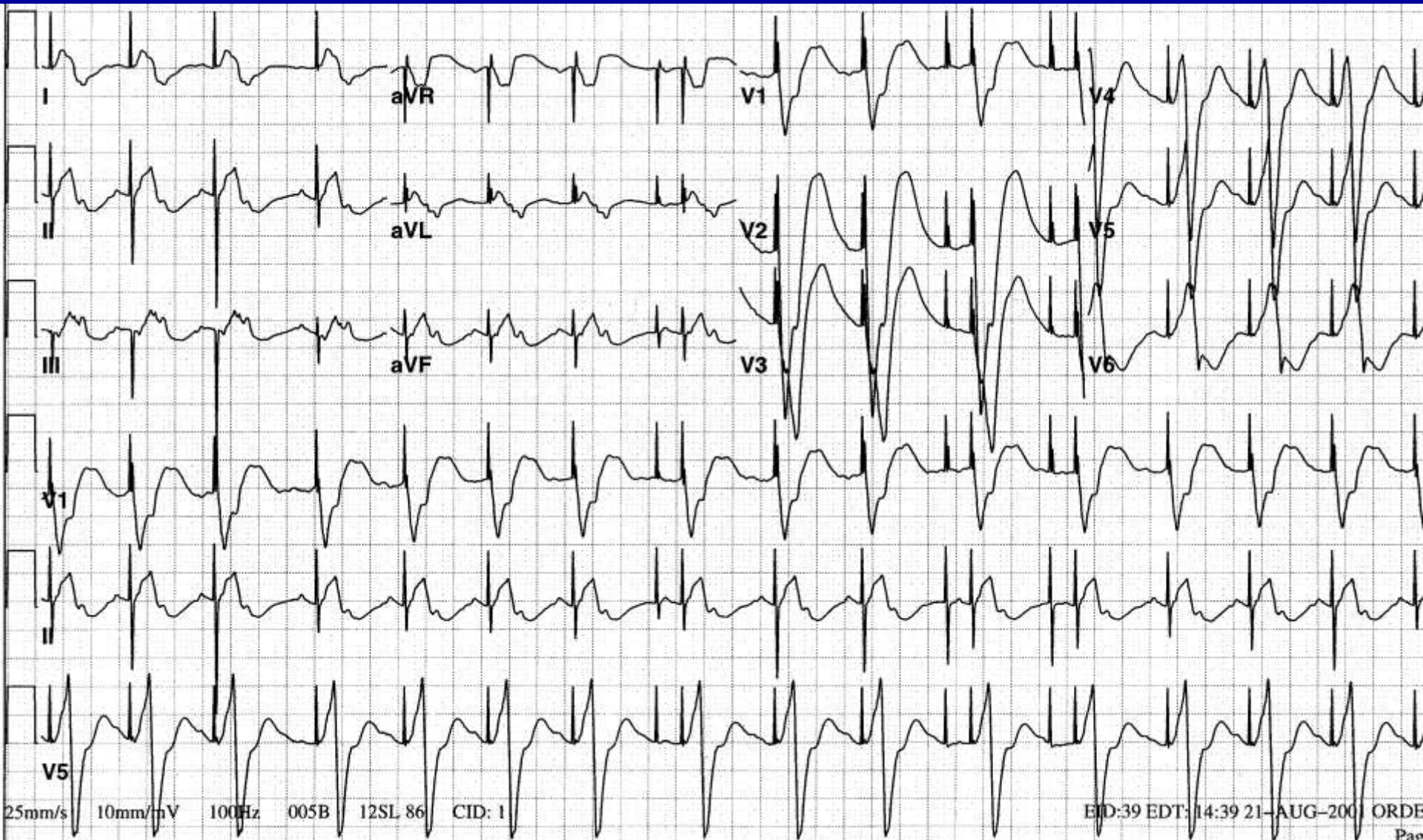


Case 23

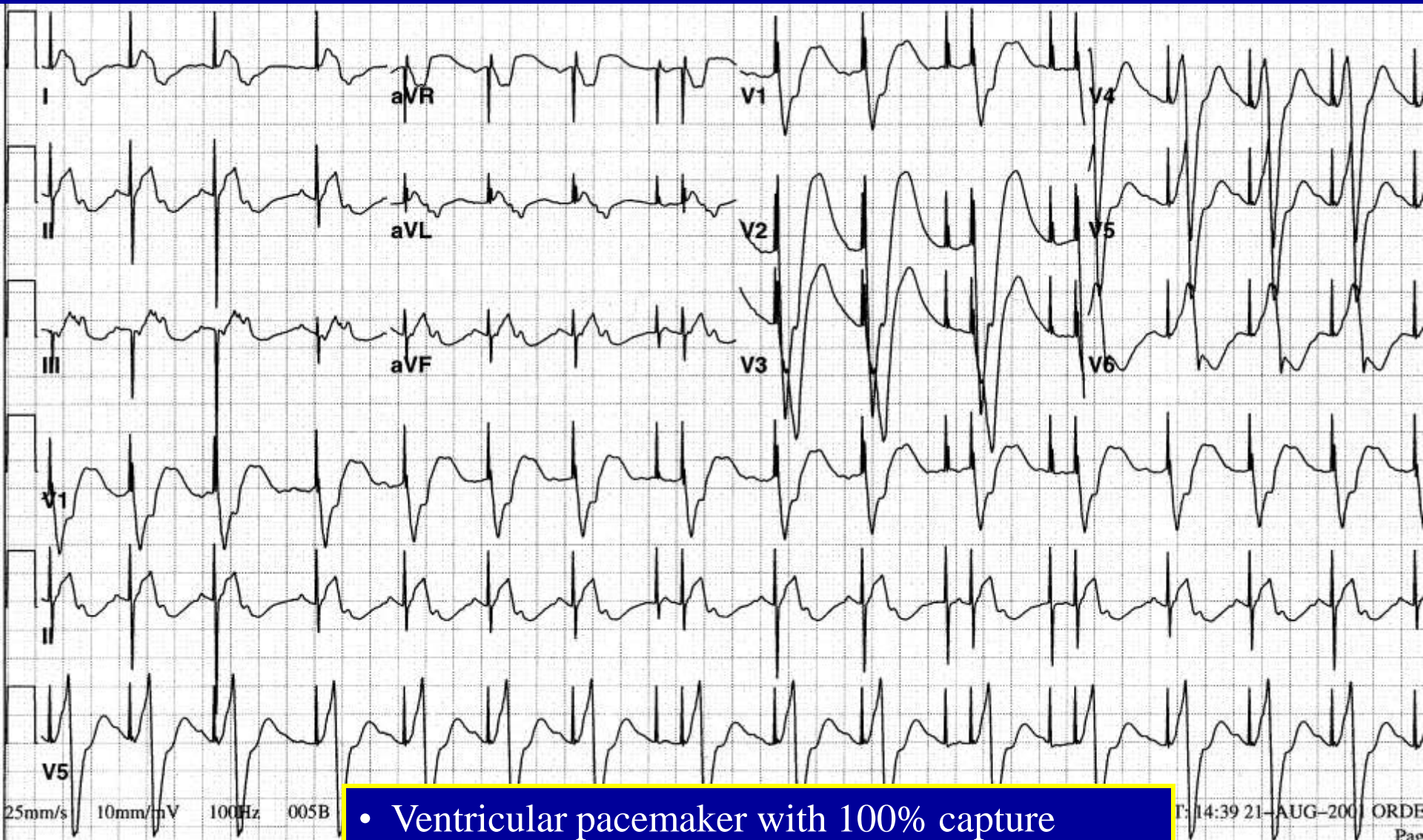


- Ventricular paced rhythm with complete capture
- Atrial flutter without evidence of AV conduction

Case 28

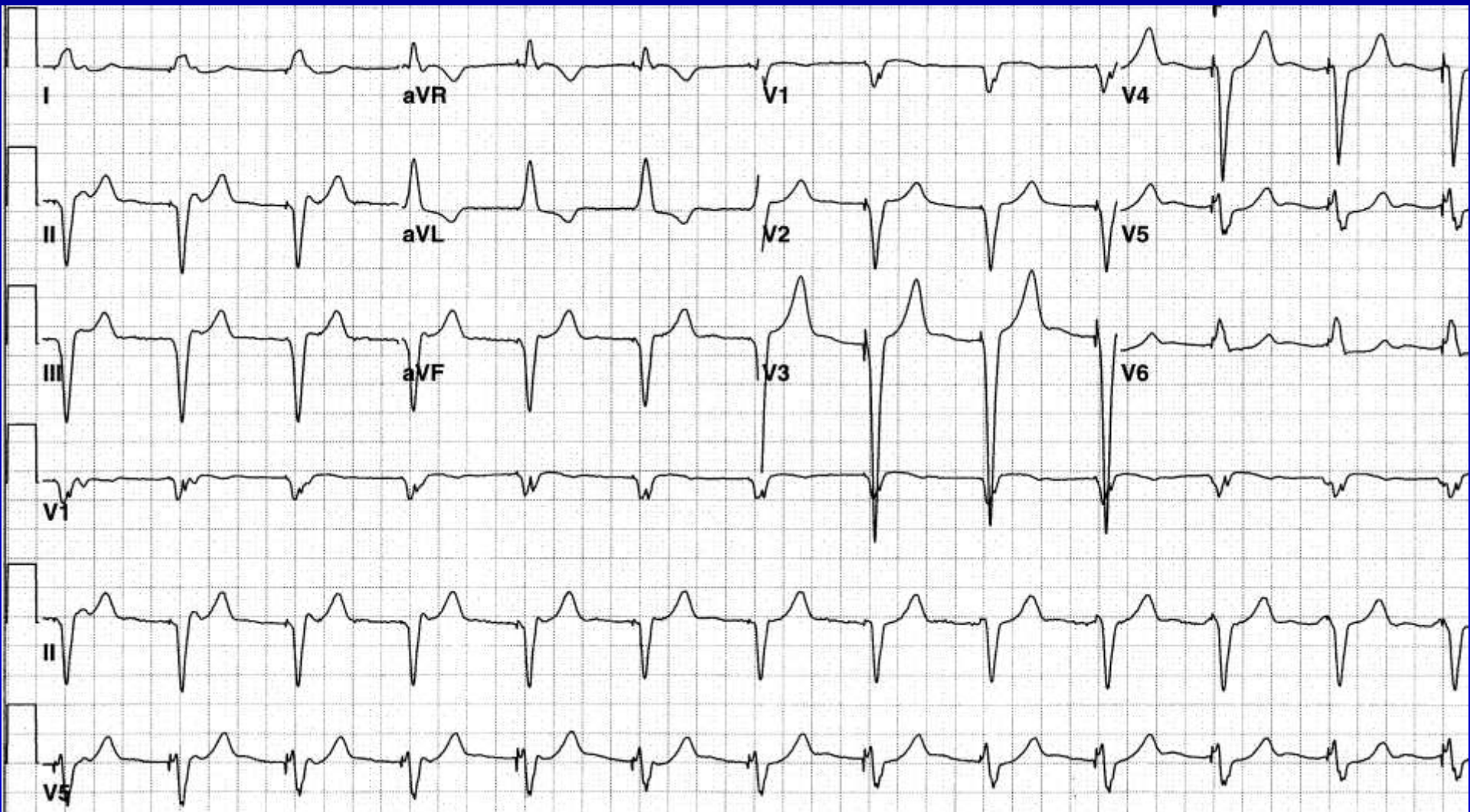


Case 28

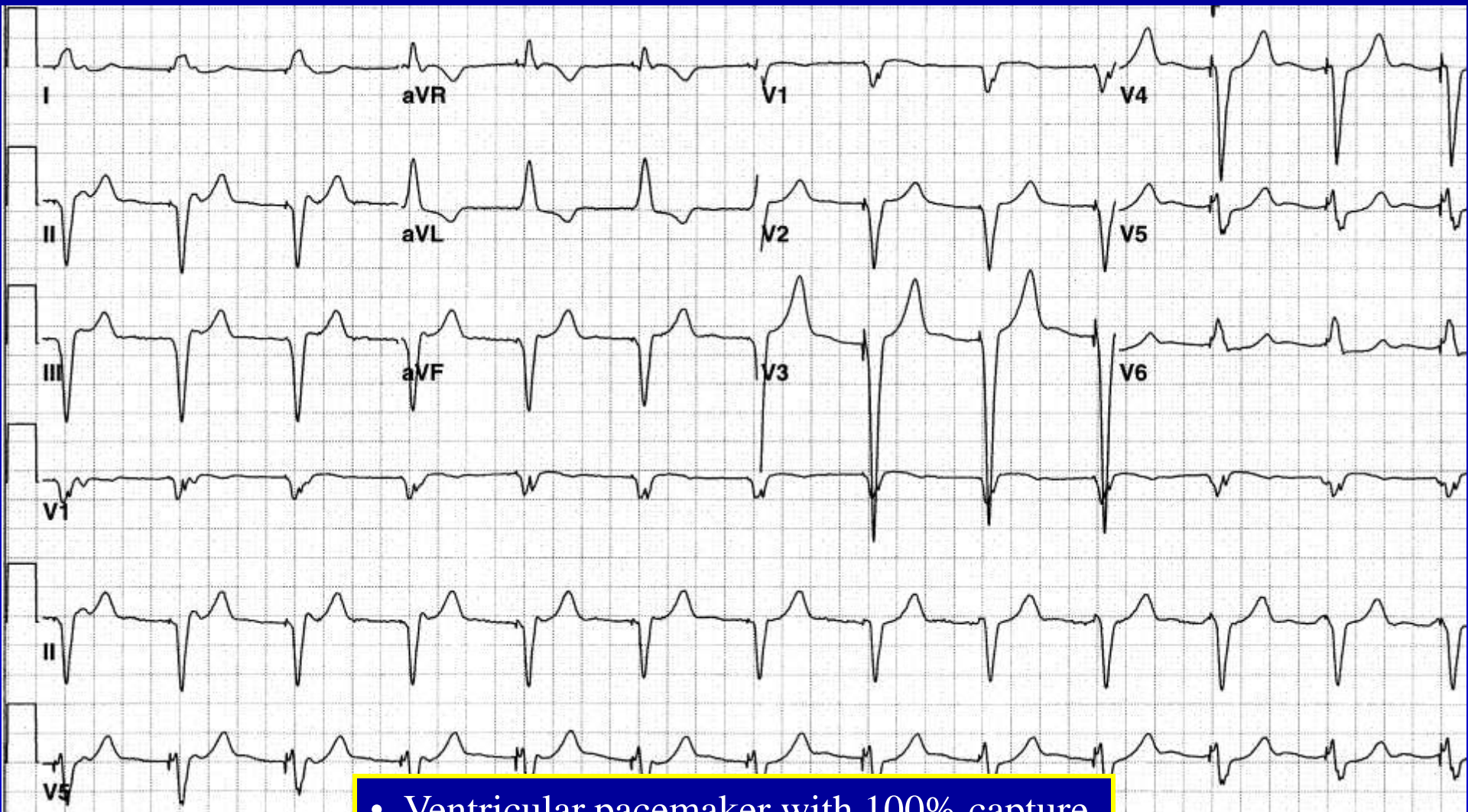


- Ventricular pacemaker with 100% capture
- Atrial pacemaker with normal sense and capture
- Sinus arrhythmia

Case 34

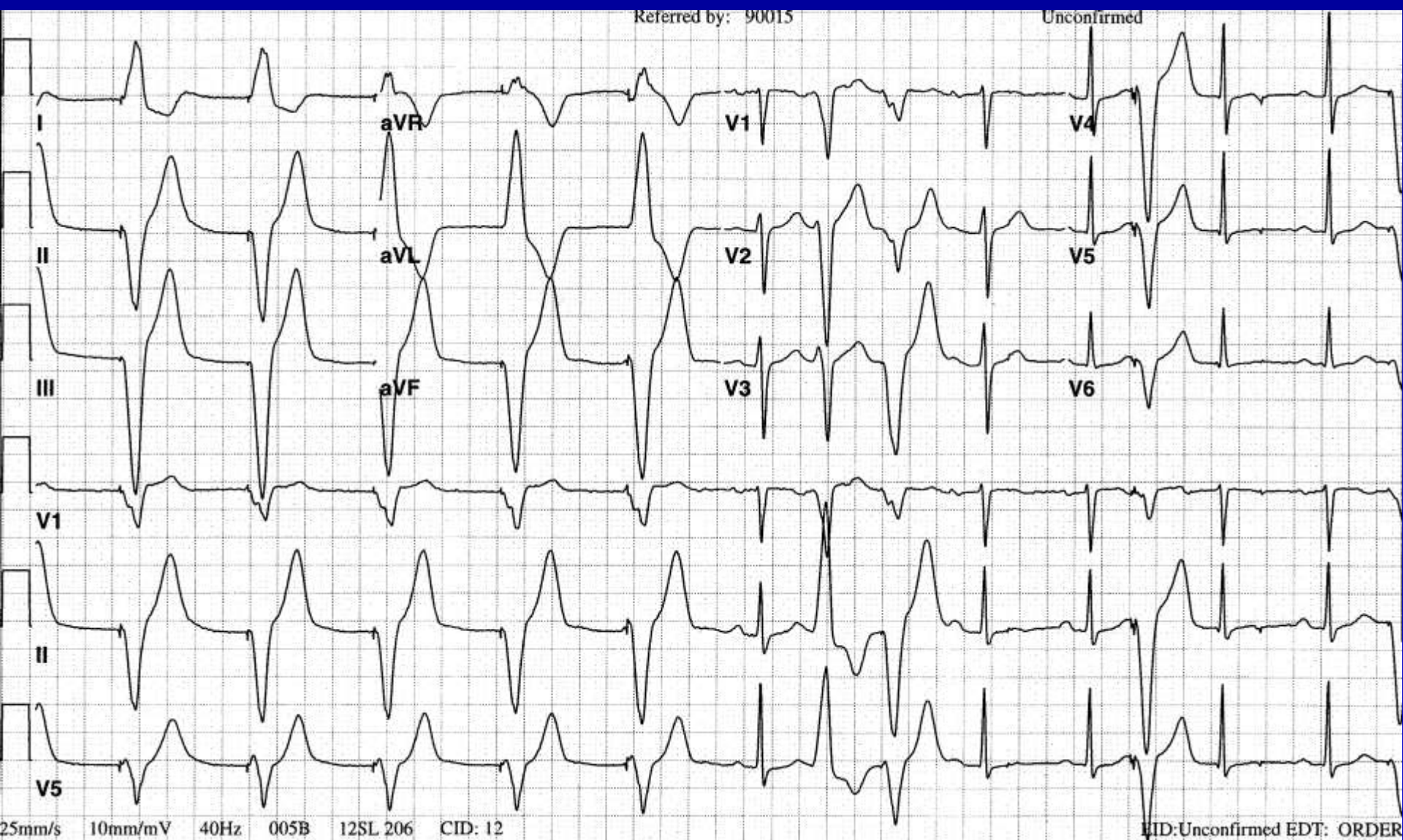


Case 34

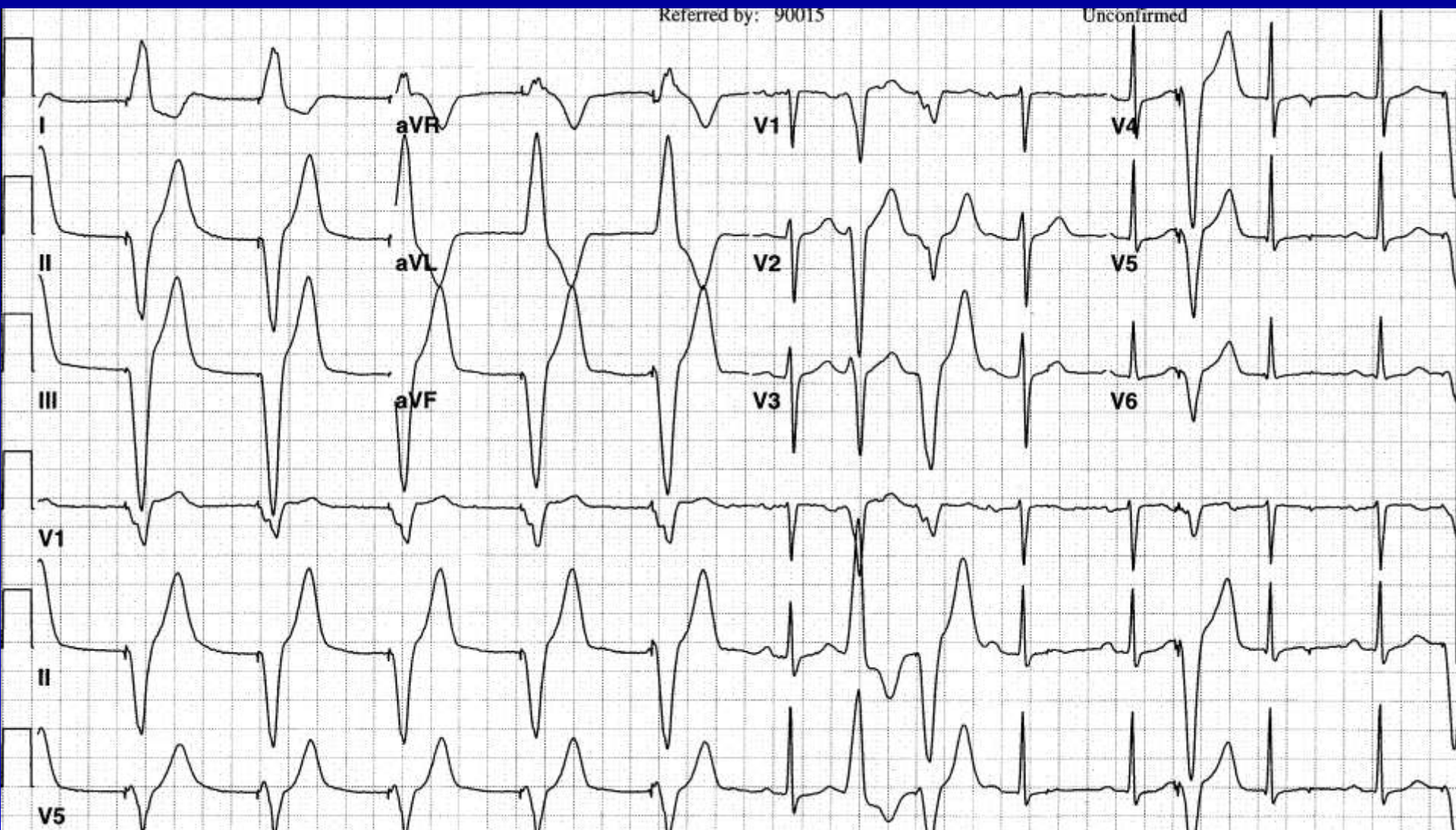


- Ventricular pacemaker with 100% capture
- Sinus rhythm rate 80
- AV Dissociation, consider AV block

Case 37

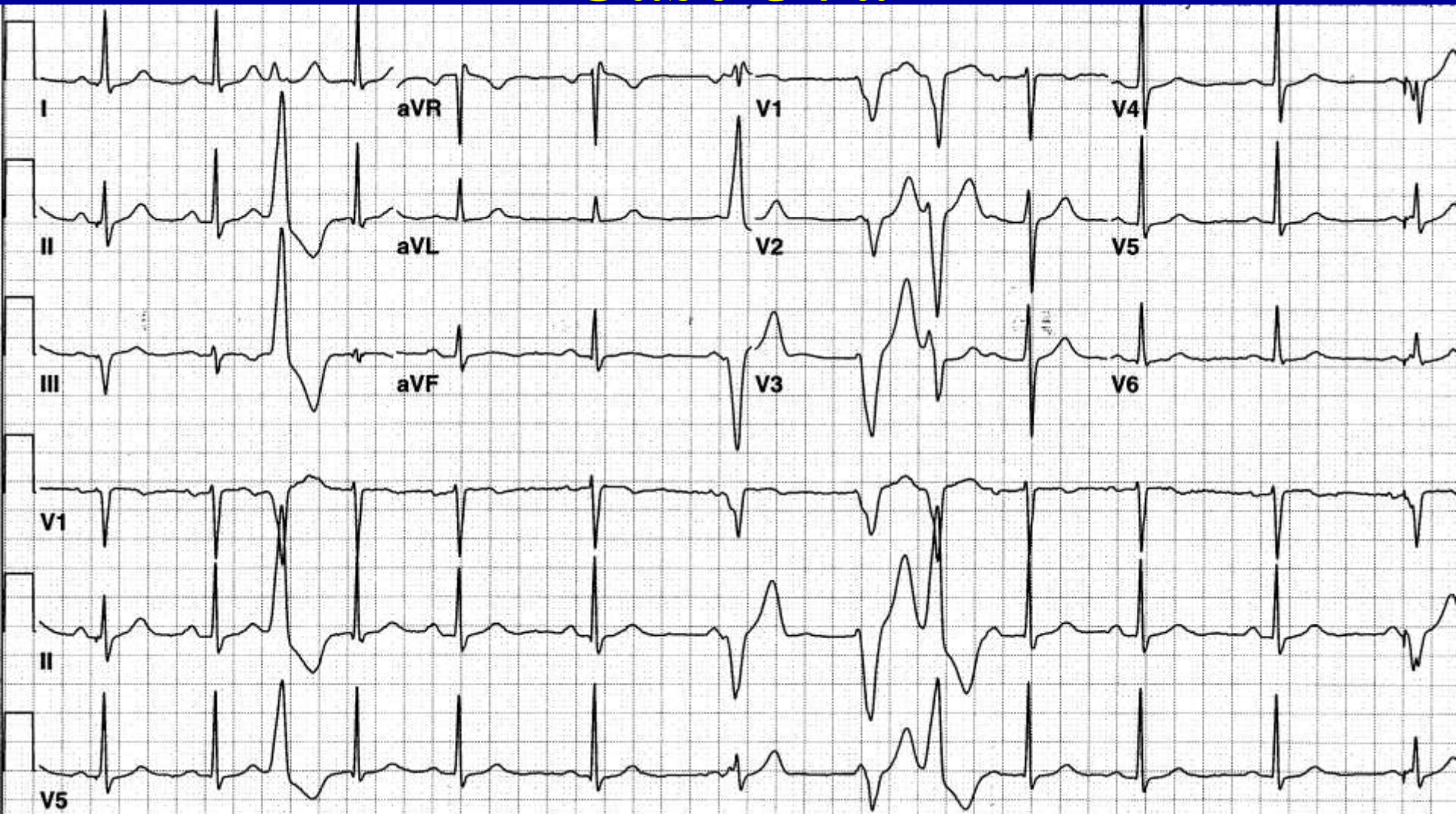


Case 37

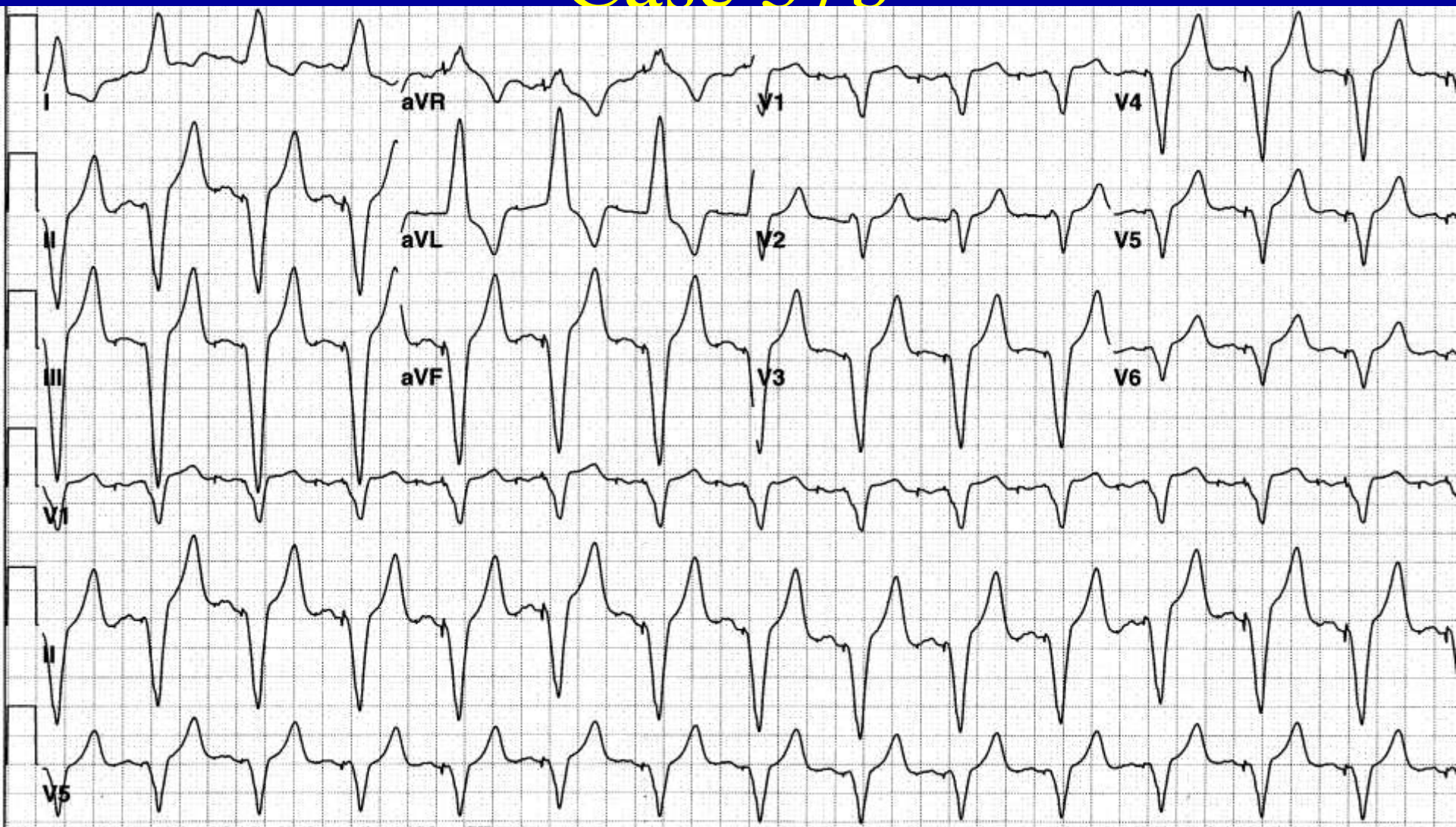


- Ventricular pacemaker with normal capture and complete failure to sense
- Sinus rhythm rate 80 with interpolated PVC's and concealed retrograde conduction

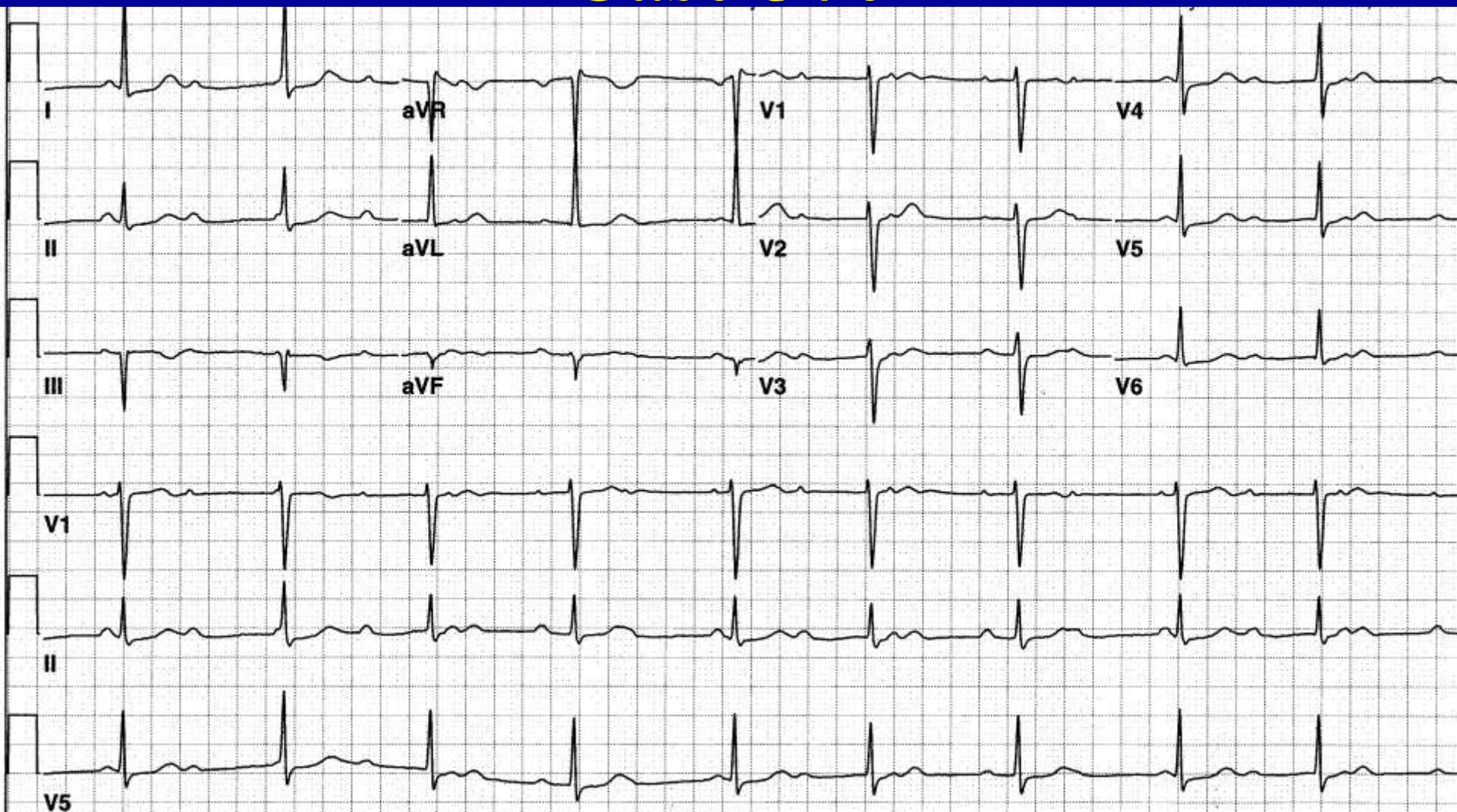
Case 37a



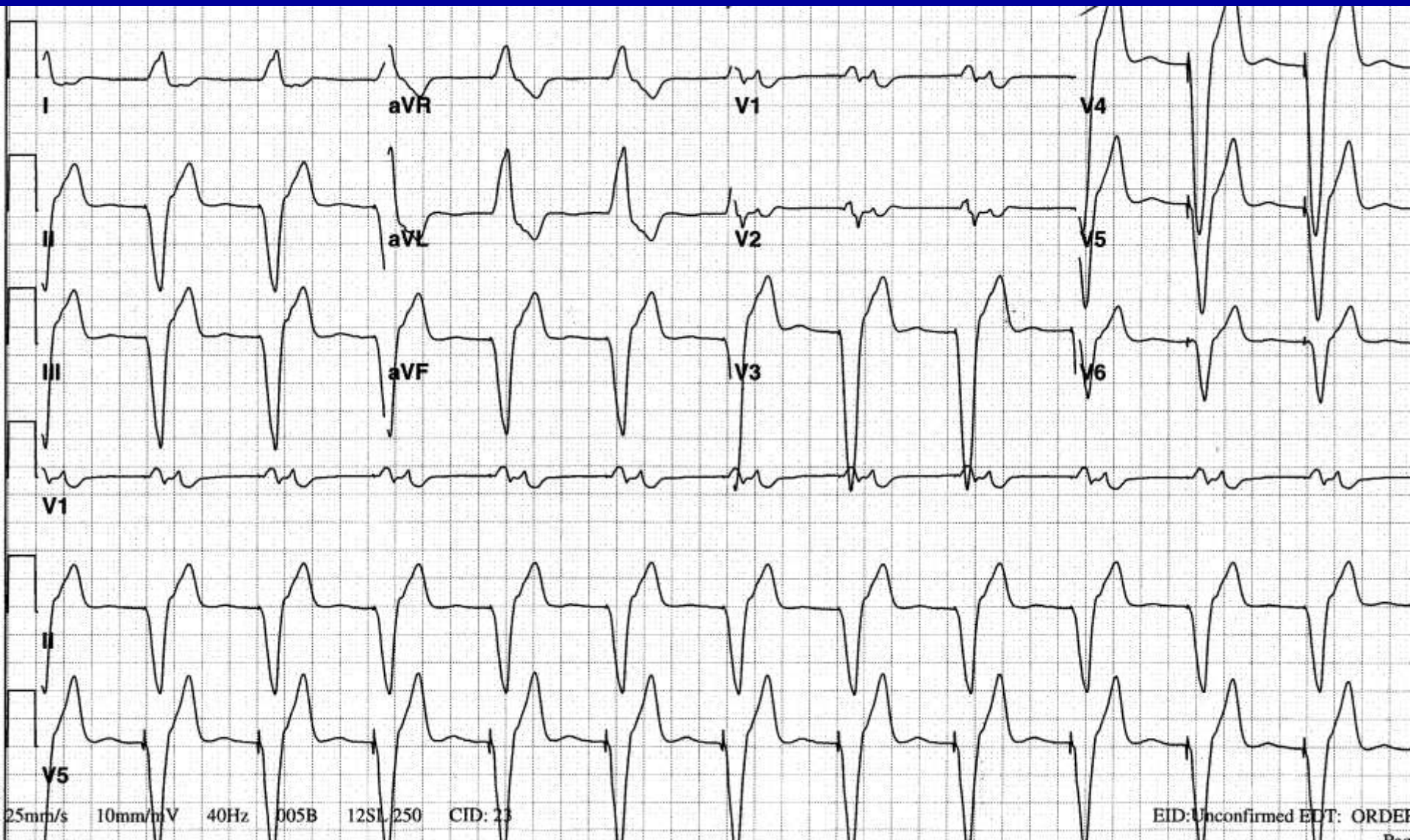
Case 37b



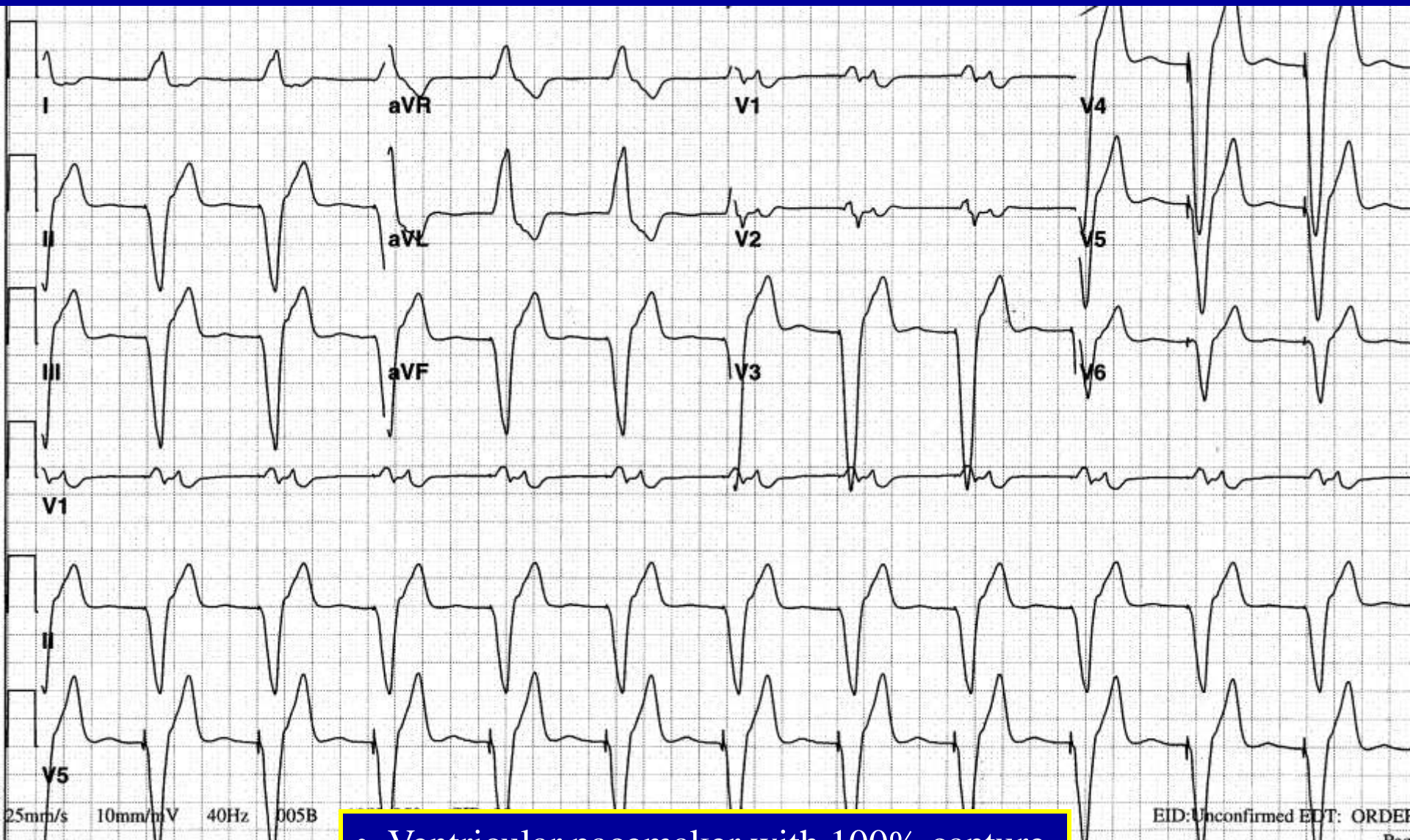
Case 37c



Case 40



Case 40



- Ventricular pacemaker with 100% capture
- Retrograde conduction, 1:1