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

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

Variable S1 intensity
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
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
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

A pace, V pace

A sense, V pace
Case 15

- Complete heart block with ventricular escape rhythm
- Atrial pacemaker with normal sense and capture
- Sinus rhythm rate 65
Case 23
- Ventricular paced rhythm with complete capture
- Atrial flutter without evidence of AV conduction
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 37c
Case 40
Case 40

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