Day 5

Funny Looking Beats

FLB’s
What Are Those Funny-Looking Beats?

Reading Assignment
(pages 27-45 in “Outline”)
The “5-Step Method”

ECG #: 

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<th>Rhythm (s)</th>
<th>Conduction</th>
<th>Waveform</th>
<th>Interpretation</th>
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<td>V=</td>
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<td>PR=</td>
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<td>QRS=</td>
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<td>QT=</td>
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<td>Axis=</td>
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1. Compute the 5 basic measurements: HR, PR interval, QRS duration, QT interval, Axis
2. What’s the basic rhythm and other rhythm statements (e.g., PACs and PVC’s)
3. Any conduction abnormalities (SA blocks, AV blocks (Types I or II), and IV blocks)
4. Waveform abnormalities beginning with P waves, QRS complexes, ST-T, and U waves
5. Final interpretations: Normal ECG or Borderline or Abnormal ECG (list final conclusions)
SB: 66 year old woman

1. What are these FLB’s?
2. What leads are misplaced?
Measurements: Rhythm (s): Conduction: Waveform: Interpretation:

A=75 V=75
PR=140
QRS=70
QT=360
Axis= +45

Sinus with 3 PVC's (RV origin)

• Normal SA, AV, IV conduction with PVC's (red arrows)
• Poor R wave progression V1-4
• V1 and V2 leads are interchanged (note small r in V1, no r in V2, and PVC morphology with notch on downstroke

Otherwise normal ECG with right ventricular PVC's (note posterior and leftward QRS direction; indicates origin in the RV)
BB: 49 year old man with symptomatic arrhythmia. What’s the origin of the FLB’s?
Measurements:
A=65 V=65
PR=180
QRS=80
QT=400
Axis= 0

Rhythm (s):
- Sinus with PVCs (RV origin)

Conduction:
- Normal SA, AV, IV
- Retrograde VA conduction with PVC’s (arrows)

Waveform:
- Normal P, QRS, ST-T
- Note PVC’s have a ‘fat’ r in V1 and delayed S nadir from QRS onset (>60 ms) indicative of RV ectopic origin.

Interpretation:
Normal ECG with right ventricular PVC's
61 year old man with palpitations; origin of FLB's?
Measurements: | Rhythm (s): | Conduction: | Waveform: | Interpretation: |
--- | --- | --- | --- |
A=85 V=85 | Sinus with frequent PACs with and without RBBB aberrant conduction | Normal SA, AV, IV (this refers to the basic rhythm, not the arrhythmia) | Poor R wave progression V1-4 | Abnormal ECG: 1. Rhythm: note: one PAC without RBBB aberration (*) has a shorter preceding RR cycle length. The refractory period of the conduction pathways increases with increases in the preceding cycle length (or with slower heart rates). |
PR=160 | Note: the qR morphology in V1 (RBBB aberrancy) is not the typical rsR' because the sinus beats lack an initial r wave. | | | |
90 year old man with chest pain (an exception to the rule)
Measurements: | Rhythm(s): | Conduction: | Waveform: | Interpretation: |
---|---|---|---|---|
A= 50 V = 50 | Sinus bradycardia with 2 PVCs | 1st degree AV block | • T wave inversion V1-6
• Poor R wave progression with QS V1-2 | Abnormal ECG:
1. Rhythm (PVC’s)
2. 1st degree AVB
3. Anteroseptal MI (age uncertain)
4. Prolonged QT interval (upper QT limit @50 bpm is 440 ms, using the poor man’s guide; see p12 in the “Outline”)
5. Marked T wave abnormality (likely related to evolving MI)
What are all the possible outcomes of a PAC? (do you see any PVC’s?)

Nice seeing ‘U’
What are all the possible outcomes of a PAC? (do you see any PVC’s?)

- **Sinus with 4 PAC’s (red arrows; Cherchez le P):**
  1. RBBB+LAFB aberration
  2. LBBB aberration
  3. Nonconducted
  4. Normal conduction

- **Normal SA, AV, IV (refers to the basic rhythm)**

- **Abnormal ECG:**
  1. Rhythm (4 PACs)
  2. Nonspecific T wave abnormalities, probably related to LVH

This is a beautiful example of the many different fates (outcomes) of a PAC!
80 year old woman on orthopedics ward
Measurements:  
- Rhythm (s): Sinus rhythm with 4 PVCs (from right ventricle; note the notch on downstroke of QRS in V1)  
- Conduction:  
  - Normal SA  
  - Prolonged AV  
  - Prolonged IV  
  - rsR' in V1, late S in I, aVL, V6  
- Waveform:  
- Interpretation: Abnormal ECG:  
  1. Rhythm (PVCs)  
  2. 1st degree AV block  
  3. RBBB  

Note the compensatory pause with the nonconducted sinus P waves hidden in the ST segment of the PVC's (*)
and then the HR slowed!
Measurements:

- A=115, V=115
- PR=140
- QRS=80
- QT=360
- Axis=0

Rhythm(s):

Sinus tachycardia with the onset of 5 PACs (arrows) in a pattern of bigeminy (only the first PAC is conducted with LAFB aberration (note the superior and leftward shift in axis; see aVL* and aVF*). The remaining PACs are nonconducted (Cherchez le P).

Conduction:

Normal SA, AV, and IV

Waveform:

- Notched P in frontal plane leads; +/- P in V1

Interpretation:

Abnormal ECG:
1. Rhythm and rate
2. Probable Left atrial enlargement

Note: the sinus tachycardia persists but is interrupted by the nonconducted PAC’s each of which resets the sinus timing resulting in an incomplete pause.

5-4 and then the HR slowed!
Oh, oh!

Measurements:  Rhythm (s):  Conduction:  Waveform:  Interpretation:

A= ?  V= ~180  Atrial fibrillation with a rapid HR response (note three LBBB aberrancies)  Normal AV, intermittent rate related LBBB  • Normal QRS  • diffuse ST-T wave abnormalities  Abnormal ECG:  1. Rhythm and rate  2. Nonspecific ST-T abnormalities

Note the 3 FLB’s resemble classic LBBB in V1 (rapid QRS downslope) and monophasic notched R in aVL) which differentiates this from RV ectopy.
TT: 44 year old man with long history of syncope and presyncope
Measurements:

- Rhythm (s):
  - Sinus rhythm with one PVC (from the LV)
- Conduction:
  - Normal SA, AV, IV
- Waveform:
  - Normal P, QRS, ST-T
- Interpretation:
  - Normal ECG with 1 PVC

Measurements:

- A=70
- V=70
- PR=160
- QRS=80
- QT=380
- Axis=0
TT: 44 year old man (same patient) with long history of syncope and presyncope (missing V6)
TT: 44 year old man with long history of syncope and presyncope (missing V6)

Measurements:

<table>
<thead>
<tr>
<th>A=</th>
<th>V=70</th>
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<tbody>
<tr>
<td>PR=160</td>
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<tr>
<td>QRS=80</td>
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<td>QT=380</td>
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<td>Axis= 0</td>
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Rhythm (s):

- Non-sustained Left ventricular tachycardia converting to sinus rhythm

Conduction:

- Retrograde V-A conduction with 2:1 V-A block

Waveform:

- Normal P, QRS (sinus beats)
- T inversion (V4,5)
- Missing V6 lead

Interpretation:

- Abnormal ECG:
  1. Rhythm (nonsustained V-Tach)
  2. Nonspecific T abnormality (in sinus rhythm)

Note: one ‘dropped’ QRS during VT suggests brief 2:1 exit block from VT focus
72 year old woman with hypertension, type 2 DM, history of A-fib; abscessed finger

Official ECG diagnosis:

- Sinus tachycardia
- Second degree AV block, type I (Wenckebach) with competing Supraventricular tachycardia
- ST & T wave abnormality, consider lateral ischemia
- Abnormal ECG
Measurements:  
- Rhythm (s):  
  Nonsustained VT converting to sinus tachycardia vs an ectopic atrial tachycardia  

Conduction:  
1. AV dissociation during the VT (first 2 arrows)  
2. 2nd degree AV block (type 1) during the sinus (or ectopic atrial) tachycardia  

Waveform:  
- Wide QRS tachycardia  
- ST depression V5-6, aVF  
- T inversion aVF, V6  

Interpretation:  
- Abnormal ECG:  
  1. Rhythms and rate  
  2. Type I second degree AVB  
  3. Nonspecific ST-T abnormalities  

Note: the wide QRS tachycardia cannot be SVT with aberration because AV dissociation confirms it is VT.
54 year old man in ICU
54 year old man in ICU

**Measurements:**
- Rhythm (s):
- Conduction:
- Waveform:
- Interpretation:

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<tbody>
<tr>
<td>A= 100 V=120</td>
<td>Ventricular tachycardia</td>
<td>AV dissociation (due to the faster VT rate than the underlying sinus rate)</td>
<td>Wide QRS tachycardia</td>
<td>Abnormal ECG:</td>
</tr>
<tr>
<td>PR: none</td>
<td>Sinus tachycardia (arrows)</td>
<td></td>
<td></td>
<td>1. Rhythm (VT)</td>
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<tr>
<td>QRS=150</td>
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<td></td>
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<td>Arguments for VT (vs SVT):</td>
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<tr>
<td>QT=360</td>
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<td></td>
<td></td>
<td>• Northwest quadrant axis (-105)</td>
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<tr>
<td>Axis= -105</td>
<td></td>
<td></td>
<td></td>
<td>• AV dissociation</td>
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Fast and furious!
Measurements: | Rhythm(s): | Conduction: | Waveform: | Interpretation:
--- | --- | --- | --- | ---
A=? V=210 | Atrial fibrillation with rapid ventricular response | Normal AV | Wide QRS tachycardia | Abnormal ECG: 1. Rhythm and rate 2. LBBB (note rapid QRS downstroke in V1 makes it unlikely to be VT)
PR= none | Note: irregular RR intervals support A-fib diagnosis. | IVCD | |
69 y.o. woman; hx hypertension; C/O dyspnea and lightheaded (in E.R.)
**Measurements:**
- Rhythm (s):
- Conduction:
- Waveform:
- Interpretation:

<table>
<thead>
<tr>
<th>A=260</th>
<th>V=260</th>
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<tbody>
<tr>
<td>PR=?</td>
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<td>QRS=130</td>
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<td>QT=200</td>
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<td>Axis~ -150</td>
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- **Atrial flutter with 1:1 conduction**
- **Incredible AV conduction due to previous flecainide treatment (speeds up AV conduction)**
- **IVCD**
- **Wide QRS tachycardia**
- **rsR' in lead V1**

Abnormal ECG:
1. Rhythm and rate
2. RBBB

Note: the triphasic rsR' (V1) makes supraventricular a more likely diagnosis than ventricular tachycardia. Atrial flutter with 1:1 conduction is only SVT that goes this fast.
69 y.o. woman; hx hypertension; C/O dyspnea and lightheaded (after initial Rx)
Measurements:  

Rhythm(s):  Atrial flutter

Conduction:  
1. Mostly 2:1 AV conduction (red arrows), but several groups with 3:2 AV conduction (blue arrows)
2. Normal IV conduction, except 2 RBBB aberrancies (*)

Waveform:  Low voltage QRS

Interpretation:  Abnormal ECG:  
1. Rhythm and rate
Initial treatment of Atrial flutter with 1:1 conduction is to slow the rate (DC cardioversion is one option; adenosine was used in this case, converting 1:1 to mostly 2:1 conduction – and the RBBB disappeared.
Lots going on! Underlying electrical problem(s)?
Measurements:  

| PR = ~120 | QRS = ~120 | QT = ? prolonged | Axis = ? |

Rhythm (s):  

1. AV sequential pacing (atrial sensed, ventricular pacing)  
2. PVCs after paced beats  
3. Polymorphic VT (Torsade's)  

Conduction:  

Normal AV; IVCD (paced beats)  
• Normal P

Waveform:  

Interpretation:  

Abnormal ECG  
1. AV pacing  
2. PVCs  
3. Brief Torsade's polymorphic VT (characteristic arrhythmia in patients with long QT intervals, not easily measured in this ECG)
Elderly man who is just in normal sinus rhythm
Measurements: | Rhythm (s): | Conduction: | Waveform: | Interpretation: |
---|---|---|---|---|
A=95, V=95 | Sinus rhythm (there is no arrhythmia; i.e., no premature beats) | • 1st degree AV block • Intermittent IVCD | • Normal P waves • Every other QRS with monophasic R in I, aVL, V5-6 • Slight ST elevation V3-4 and Inverted T waves II, III, aVF, V2-3 (in those narrow QRS complex beats) | Abnormal ECG: 1. 1st degree AVB 2. 2:1 LBBB (rate related) 3. Nonspecific ST-T wave abnormalities (consider ischemia and/or evolving NSTEMI) (This ECG illustrates that LBBB may mask the ST-T findings of ischemic heart disease.) |
PR= 240 | | | Note: the wide QRS beats (LBBB) do not have abnormal ST-T morphology. |