Day 10
Miscellaneous ECG’s
HR: 50 bpm (Sinus)
PR: 280 ms
QRS: 120 ms
QT: 490 ms
Axis: -70°

Sinus bradycardia with one ventricular escape (*)

Conduction:
- 2° Sino-atrial block (? LAE)
- Nonspecific IVCD

Waveform:
- Notched, wide P’s in II, III
- Poor R wave progression
- Inverted T in I, V4-6
- ST↓ I, II, III, V4-6

Abnormal ECG:
1. 2° Sino-atrial block
2. Left axis deviation
3. Nonspecific IVCD
4. Nonspecific ST-T abnormalities

The pause (2 sinus cycles) suggests that the sinus fired (?) but did not conduct to the atria (i.e., missing P wave).
SJ: 20-Feb-2014 (admission ECG): Hint: a lot of P waves, all doing something!
Atrial: ~100 bpm
Ventricular: ~60 bpm
PR: 360 ms & 440 ms
QRS: 150 ms
Axis: 0°

Ectopic atrial rhythm:
(note P wave morphology is not sinus)

Complete LBBB with typical ST-T changes

• 2nd degree AV block with 2:1 conduction
  (note the 2 PR intervals)

• Intermittent 2:1 exit block from the ectopic atrial pacemaker (this explains the 1120 ms interval between P waves)

My very cool interpretation!
Our anxious patient is a 26 yr. old man. He feels a lump in his throat and complains of palpitation. He also feels dizzy, has tremulous and sweating with hyper-dynamic circulation, visible carotid pulsation and enlarged thyroid gland. His BP 130/70, PR is irregular at about 86/min, afebrile.

His diagnosed is: Acute Thyrotoxicosis.

Could you give a diagnosis to his ECG?
The P wave and the PR progressive prolongation is clearer here as the sinus rate became slower.

When PR interval prolongs, the P wave is pushed towards the preceding R wave. It is important to plot & measure the PP interval to detect the P wave when it comes on the T wave, as an example.
Measurements:  
<table>
<thead>
<tr>
<th></th>
<th>Rhythm (s):</th>
<th>Conduction:</th>
<th>Waveform:</th>
<th>Interpretation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A=95 V=95</td>
<td>Sinus rhythm</td>
<td>Short PR</td>
<td>Prominent delta waves (arrows)</td>
<td>Abnormal ECG: 1. Preexcitation, WPW type with secondary ST-T changes</td>
</tr>
<tr>
<td>PR=100</td>
<td></td>
<td>IVCD</td>
<td>ST depression I, aVL, V3-6</td>
<td></td>
</tr>
<tr>
<td>QRS=120</td>
<td></td>
<td></td>
<td>T inversion I, V6</td>
<td></td>
</tr>
<tr>
<td>QT=340</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axis= -40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DW: 53 yr. woman
Measurements:

Rhythm:
- A=300
- V=150

Conduction:
- PR= ?
- QRS=70
- QT=320
- Axis= +120

Waveform:
- Flutter waves (arrows) with saw-tooth pattern II, III, aVF
- Poor R wave progression, V1-6

Interpretation:
- Atrial flutter, 2:1 AV block
- Right axis deviation (? etiology)

Hint: In every regular SVT @ ~150 bpm, always consider atrial flutter with 2:1 block as the first possible diagnosis!
JW: Age 67, Official ECG interpretation!

### ECG Findings

- **Rate:** 61 BPM
- **PR interval:** 126 ms
- **QRS duration:** 102 ms
- **QT/QTc:** 456/459 ms
- **P-R-T axes:** *-58* 96

- **Interpretation:**
  - Sinus rhythm with Fusion complexes
  - Left axis deviation
  - Inferior infarct, age undetermined
  - Abnormal ECG

**Note:** No previous ECGs available
Measurements: | Rhythm (s): | Conduction: | Waveform: | Interpretation: |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A=60 V=60</td>
<td>Sinus rhythm</td>
<td>IVCD (1st 5 beats)</td>
<td>Suspicious q waves II, III, aVF (actually, negative delta waves)</td>
<td>Abnormal ECG: 1. Intermittent WPW preexcitation (first 5 beats) followed by normal IV conduction (last 5 beats) Note: there is no ECG evidence of inferior myocardial infarction. Preexcitation using accessory pathways can be intermittent as seen in this ECG.</td>
</tr>
<tr>
<td>PR= 120 &amp; 160</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QRS=110 &amp; 90</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QT= ~440</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axis= -60 (1st 5 beats)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
36 year old man: What are ‘Viagra’ P waves?
<table>
<thead>
<tr>
<th>Measurement:</th>
<th>Rhythm (s):</th>
<th>Conduction:</th>
<th>Waveform:</th>
<th>Interpretation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A=85</td>
<td>Sinus rhythm</td>
<td>Normal SA, AV, and IV</td>
<td>• P &gt; 2.5 mm in II, V2-5 • ST↓ II, III, aVF, V2-5 • Inverted T in III, aVF, V1-4 • qR in V1</td>
<td>Abnormal ECG 1. Right atrial enlargement* 2. Right axis deviation 3. Right ventricular hypertrophy with strain (ST-T abnormalities)</td>
</tr>
<tr>
<td>V=85</td>
<td></td>
<td></td>
<td></td>
<td>*Viagra P waves: Well, isn’t it obvious?</td>
</tr>
<tr>
<td>PR=160</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QRS=70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QT=360</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axis=+110</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
KC: Age 71
### Measurements:
- **Rate (A):** 130
- **Rate (V):** 110
- **PR:** varies
- **QRS:** 80
- **QT:** 320
- **Axis:** –30

### Rhythm(s):
- Sinus tachycardia and 2 PVC's (*)

### Conduction:
- 2nd degree AV block (type I, 3:2 conduction); follow the arrows!

### Waveform:
- P wave wide, notched in II, III with prominent negative force in V1

### Interpretation:
- **Abnormal ECG:**
  1. Type I 2nd degree AV block
  2. LAE
  3. PVC's

  **Hint:** look for repetitive groups of beats separated by a pause; **think Wenckebach!**
33 year old woman with history of syncope
**Measurements:**
- **Rhythm (s):**
  - Sinus arrhythmia (arrows indicate P waves)
  - Junctional escape beats (J)
  - (C) Indicates the sinus captures
- **Conduction:**
  - 2nd degree AV block (probably type I because the QRS is narrow, and the PR is prolonged)
- **Waveform:**
  - Normal P, QRS, ST-T waves
- **Interpretation:**
  - Abnormal ECG:
    1) 2nd degree AVB (probably type I)
    2) It is not unusual for long cycles to be terminated with junctional escapes (J); also, junctional escapes may look slightly different from the sinus beats (notice larger S waves in the lead V1 rhythm strip)

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Rhythm (s):</th>
<th>Conduction:</th>
<th>Waveform:</th>
<th>Interpretation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A ~50 V ~40</td>
<td>• Sinus arrhythmia (arrows indicate P waves)</td>
<td>2nd degree AV block (probably type I)</td>
<td>Normal P, QRS, ST-T waves</td>
<td>Abnormal ECG:</td>
</tr>
<tr>
<td>PR=240 for conducted beats (C)</td>
<td>• Junctional escape beats (J)</td>
<td>(probably type I because the QRS is narrow, and the PR is prolonged)</td>
<td></td>
<td>1) 2nd degree AVB (probably type I)</td>
</tr>
<tr>
<td>QRS=</td>
<td>(C) Indicates the sinus captures</td>
<td></td>
<td></td>
<td>It is not unusual for long cycles to be terminated with junctional escapes (J); also, junctional escapes may look slightly different from the sinus beats (notice larger S waves in the lead V1 rhythm strip)</td>
</tr>
</tbody>
</table>
83 year old man; lightheaded
Measurements: | Rhythm(s): | Conduction: | Waveform: | Interpretation:
---|---|---|---|---
A=70 V=60 | • Sinus rhythm (arrows) • Ventricular escapes from the RV (*) | • Type I 2nd degree AV block • RBBB | • Normal P waves • rsR' in V1 (RBBB) Leads V2 and V3 are misplaced; V3 is really V2 and V2 is V3 (notice the QRS morphology clues) | Abnormal ECG: 1. 2nd degree AV block (type I) 2. RBBB Note: the P waves preceding the escape beats are dissociated from the QRS even though they appear related to the QRS; escape beats often terminate long pauses. The P and QRS are unrelated.
PR= varies
QRS=120
QT=400
Axis= 0
SC: 37 year old man; status post-op aortic valve bioprosthesis with new aortic insufficiency

This last ECG indicates how complex relationships between atria and ventricles can be a fun challenge!
• Ectopic atrial rhythm (80 bpm; note inverted P’s in II, III, aVF)
• Intermittent Junctional rhythm (J = 60 bpm)
• Incomplete AV dissociation with ectopic atrial captures (C); note: shorter RR’s (arrows) indicate the captured beats (C).