Differential Diagnosis

Clues before the patient gets to the lab

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Overview

• Signs and symptoms of Arrhythmia
• Gender differences in Arrhythmias
• The response to adenosine
• VA Relationships
• ECG as a directionality tool
• Other tools at our disposal
Preparing your own CHECKLIST

When completing this checklist, provide as many details as possible about your symptoms. If you have a friend or family member who has been with you whilst you have experienced your symptoms, it may be useful to ask for their help to complete the form.

Name: .................................................................

1. List any medication(s) you are currently taking:
   ........................................................................
   ........................................................................
   ........................................................................

2. What symptoms do you experience?
   (Tick as appropriate)
   □ Palpitations
   □ Shortness of breath
   □ Fatigue
   □ Loss of consciousness/fainting
   □ An increase in stress level
   □ Chest pain
   ........................................................................

3. How frequently do you experience your symptoms? (Tick as appropriate)
   □ Daily
   □ Weekly
   □ Every one to two weeks
   □ Once a month or less frequently
   ........................................................................

4. Does anything trigger your symptoms?
   (Tick more than one if appropriate)
   □ Alcohol
   □ Anxiety
   □ Being very hot
   □ Caffeine
   □ Exercise
   □ Flashing lights
   □ Going from sitting or lying to standing
   □ Lack of sleep
   □ Not eating
   □ Pain or a fright
   □ Standing for a long time
   □ Stress
   □ No trigger
   □ Other (give details below)
   ........................................................................

5. Before you experience your symptoms, do you have any warning signs? (Tick as appropriate)
   □ Breathlessness
   □ Light-headedness
   □ Nausea
   □ Palpitations
   □ Racing pounding heart
   □ Sweating
   □ No warning signs
   □ Other (give details below)
   ........................................................................

6. Medical and Family History
   Have you been investigated for a heart rhythm disorder before?
   □ Yes □ No
   Have you ever been admitted to hospital with what was thought to be a heart related problem?
   □ Yes □ No
   Are there any heart conditions or other diseases that you are aware of in your family?
   ........................................................................
   Has anyone ever died unexpectedly at a young age (under 45 years) in your family? What was the cause?
   ........................................................................

7. Lifestyle
   At times when you are not experiencing symptoms, are you able to climb up stairs and walk up a hill or carry out other types of normal everyday exertion?
   □ Yes □ No
   If not, what stops you? .................................................................
   Please remember this checklist provides general guidelines only. Share with your doctor when discussing your symptoms.

For further information and advice contact:
Arrhythmia Alliance, Unit 6B, Essex House, Cromwell Business Park, Chipping Norton, Oxfordshire OX7 5SR
info@arrhythmiaalliance.org  www.heartarrhythmia.org
Registered Charity Number: 1137945. © Arrhythmia Alliance Published March 2013, Reviewed December 2016

AAA
www.heartarrhythmia.org
Signs and Symptoms of Arrhythmias

2. What symptoms do you experience?
   (Tick as appropriate)
   - Palpitations
   - Shortness of breath
   - Fatigue
   - Loss of consciousness/fainting
   - An increase in stress level
   - Chest pain
Signs and Symptoms of Arrhythmias
Signs and Symptoms of Arrhythmias

3. How frequently do you experience your symptoms? (Tick as appropriate)

- [ ] Daily
- [ ] Weekly
- [ ] Every one to two weeks
- [ ] Once a month or less frequently
Signs and Symptoms of Arrhythmias

• Does it feel regular or irregular?
• How long do they last?
• Is there any thing that you do that stops it?
Signs and Symptoms of Arrhythmias

4. Does anything trigger your symptoms?  
   (Tick more than one if appropriate)
   - Alcohol
   - Anxiety
   - Being very hot
   - Caffeine
   - Exercise
   - Flashing lights
   - Going from sitting or lying to standing
   - Lack of sleep
   - Not eating
   - Pain or a fright
   - Standing for a long time
   - Stress
   - No trigger
   - Other (give details below)
Signs and Symptoms of Arrhythmias

6. Medical and Family History

Have you been investigated for a heart rhythm disorder before?

☐ Yes ☐ No

Have you ever been admitted to hospital with what was thought to be a heart related problem?

☐ Yes ☐ No

Are there any heart conditions or other diseases that you are aware of in your family?

Has anyone ever died unexpectedly at a young age (under 45 years) in your family? What was the cause?
Signs and Symptoms of Arrhythmias

7. Lifestyle

At times when you are not experiencing symptoms, are you able to climb up stairs and walk up a hill or carry out other types of normal everyday exertion?

☑️ Yes ☐ No

If not, what stops you? ..............................................
Signs and Symptoms of Arrhythmias

1. List any medication(s) you are currently taking:

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Gender differences in Arrhythmia

• Pathophysiology of AVNRT
  – 2:1 ratio of women to men
  – Further analysis showed that younger women tended to have multiple jumps and shorter electrophysiological properties than that of men.
    • Women with AVNRT have shorter slow pathway refractory periods, AV block cycle lengths, and tachycardia cycle lengths than men with AVNRT
    • Thought to be due to ovarian hormones or increased sympathetic activity during the luteal phase

Gender differences in Arrhythmia

- women have a wider “tachycardia window,” representing the difference between the fast and slow pathway refractory periods, which might explain the higher incidence of AVNRT.


Gender differences in Arrhythmia

• A slight male predominance in AVRT (52-58%)
  – Increasing prevalence of male subjects may be attributed to prolongation of AV conduction time with growth, especially in boys after puberty
  – Tachycardia via accessory pathways appears to occur later in women than men

• Differences in AV conduction properties or electrophysiology of AP conduction between sexes may account for differences in the frequency of pathway-mediated tachycardia and the incidence of overt pre-excitation.

Gender differences in Arrhythmia

- AF has a significant (1.5x) prevalence of men compared to women.
  1. This may be a consequence of a higher incidence of risk factors occurring in men compared to women
     - MI and heart failure
  - However, AF tends to occur later in women (+ women live longer), studies have attributed this to shorter refractory periods and protective role of estrogen

Gender differences in Arrhythmia

VT

- RVOT
  - Prevalence of 2:1 towards women
- LVOT
  - Slight prevalence (~58%) to men
- LV-VT (septal)
  - Prevalence of 3.5:1 towards men

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
<th>SVT Mechanism(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. VA relationship</td>
<td>$V = A$</td>
<td>AVNRT, AVRT, AT</td>
</tr>
<tr>
<td></td>
<td>$V &gt; A \pm AV$ dissociation</td>
<td>ONVRT, ONFRT, AVNRT</td>
</tr>
<tr>
<td></td>
<td>$V &lt; A$</td>
<td>AVNRT, AT</td>
</tr>
<tr>
<td>2. VA interval</td>
<td>$VA &gt; 70$ ms</td>
<td>aAVNRT, AVRT, AT</td>
</tr>
<tr>
<td></td>
<td>$VA \leq 70$ ms</td>
<td>tAVNRT, AT</td>
</tr>
<tr>
<td></td>
<td>$VA &gt; AV$</td>
<td>aAVNRT, AT, AVRT using slowly conducting AP</td>
</tr>
<tr>
<td>3. Atrial activation sequence</td>
<td>High to low</td>
<td>AT</td>
</tr>
<tr>
<td></td>
<td>Concentric</td>
<td>AVNRT, AVRT, AT</td>
</tr>
<tr>
<td></td>
<td>Eccentric</td>
<td>AVRT, AT*</td>
</tr>
<tr>
<td>4. Spontaneous termination</td>
<td>Ends with an “A”</td>
<td>AVNRT, AVRT</td>
</tr>
<tr>
<td></td>
<td>Ends with a “V”</td>
<td>AVNRT, AVRT</td>
</tr>
<tr>
<td>5. HH changes precede and predict</td>
<td>Yes</td>
<td>AVNRT, AVRT</td>
</tr>
<tr>
<td>AA changes</td>
<td>No</td>
<td>AVNRT, AVRT, AT</td>
</tr>
<tr>
<td>6. VA increase $&gt; 30$ ms with functional BBB</td>
<td>Yes</td>
<td>AVRT with free wall AP ipsilateral to BBB</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>AVNRT, AVRT, AT</td>
</tr>
</tbody>
</table>
The response to Adenosine

- Works by supressing the AV Node (dromotropy)
The response to Adenosine
The response to Adenosine

- Adenosine in AP
The response to Adenosine
The response to Adenosine
The response to adenosine

Atrial Flutter
The response to Adenosine

- Pitfalls........

**Fig. 1.**

a. Twelve-lead electrocardiogram at initial presentation. b. Onset of ventricular fibrillation following administration of adenosine.
The response to Adenosine

• What does it really tell us??

4. Spontaneous termination

- Ends with an “A”
- Ends with a “V”
- AVNRT, AVRT
- AVNRT, AVRT, AT
## VA Relationships

1. **VA relationship**
   - \( V = A \)
   - \( V > A \pm \text{AV dissociation} \)
   - \( V < A \)
   - AVNRT, AVRT, AT
   - ONVRT, ONFRT, AVNRT
   - AVNRT, AT

2. **VA interval**
   - \( VA > 70 \text{ ms} \)
   - \( VA \leq 70 \text{ ms} \)
   - \( VA > \text{AV} \)
   - aAVNRT, AVRT, AT
   - tAVNRT, AT
   - aAVNRT, AT, AVRT using slowly conducting AP

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Diagnostic Pacing Manoeuvres for Supraventricular Tachycardia: Part 1 Veenhuyzen et al 2011 Table 1
VA interval

VA >70ms

AV 40ms
VA interval

VA interval <70ms

AV longer than VA
VA Relationship
ECG as a directionality tool

• The ECG is a surrogate for Unipolar EGMs
ECG as a directionality tool

• That is, a depolarisation wavefront propagating towards an electrode generates a positive inflection

• As the wavefront reaches the electrode and propagates past it, it generates a negative inflection.

• The same inference can be made for ECGs
ECG as a directionality tool
ECG as a directionality tool

• Thus Negative inflections in:
  – II, III, aVF and aVR refer to R-side
  – I, aVL, V3, V4, V5, V6 refer to left side
  – V1 and V2 delineate septal position
ECG as a directionality tool

Positive inflection

Negative inflections
ECG as a directionality tool

- Old school thinking (in relation to VT)
  - RBBB means LV
  - LBBB means RV
ECG as a directionality tool

Negative inflections

Positive inflections
ECG as a directionality tool

Negative inflections

Positive inflections
ECG as a directionality tool

“A focus of abnormal excitable tissue fires off quickly resulting in a sustained Ventricular Tachycardia”
Other tools at our disposal

• Linq/Reveal devices
Other tools at our disposal
Other tools at our disposal

1. VA relationship
   - V = A
   - V > A ± AV dissociation
   - V < A
     - AVNRT, AVRT, AT
     - ONVRT, ONFRT, AVNRT
     - AVNRT, AT

2. VA interval
   - VA > 70 ms
   - VA ≤ 70 ms
   - VA > AV
     - aAVNRT, AVRT, AT
     - tAVNRT, AT
     - aAVNRT, AT, AVRT using slowly conducting AP
1. VA relationship
   \[ V = A \]
   \[ V > A \pm AV \text{ dissociation} \]
   \[ V < A \]
   \[ \text{AVNRT, AVRT, AT} \]
   \[ \text{ONVRT, ONFRT, AVNRT} \]
   \[ \text{AVNRT, AT} \]

2. VA interval
   \[ VA > 70 \text{ ms} \]
   \[ VA \leq 70 \text{ ms} \]
   \[ VA > AV \]
   \[ \text{aAVNRT, AVRT, AT} \]
   \[ \text{tAVNRT, AT} \]
   \[ \text{aAVNRT, AT, AVRT using slowly conducting AP} \]

4. Spontaneous termination
   Ends with an “A”
   Ends with a “V”
   \[ \text{AVNRT, AVRT} \]
   \[ \text{AVNRT, AVRT, AT} \]
Other tools at our disposal
Other tools at our disposal

EGM displayed at 25mm per second

1. VA relationship

\[ V = A \]
\[ V > A \pm AV\text{ dissociation} \]
\[ V < A \]

AVNRT, AVRT, AT
ONVRT, ONFRT, AVNRT
AVNRT, AT
Other tools at our disposal
Exceptions to the rule
Exceptions to the rule
Summary

• What pts tell us about their ‘palpitations’ is important (our first clue).
• Gender differences do have an influence on what arrhythmia we think the patient has.
• How a tachycardia finishes (either phamarcologically or spontaneous) influences what the tachycardia is.
• The ECG is an important (and cheap) tool at our disposal.
• Make use of all the tools to identify tachyarrhythmia