Atrial Fibrillation

- Intro / Foundation
  - Scope of problem
    - Prevalence: 0.1% in adults < 55, 9 percent in those > 80
    - ATRIA study: 2.3 million adults in 1996 / 1997, projected to reach 5.6 million by 2050
  - Consequences: Emboli and decreased cardiac output
    - AF + acute abdominal pain = SMA embolism
    - AF + neuro changes = immediate stroke eval
    - AF + hypotension = unstable tachyarrhythmia = cardiovert
  - Anatomy: FIGURE
    - Origin of arrhythmia: Predominantly triggered from pulmonary veins; less commonly can be from other foci, particularly SVC, coronary sinus. Can be triggered from other arrhythmias (AT, flutter)
    - Mechanisms: Stretch sensitive ion channels (distension), fibrosis, micro re-entry
    - Perpetuated by atrial electrical remodeling
    - Origin of thrombus (LAA)
  - H & P
    - History:
      - Sx: palps, fatigue, weakness, increased urination (elevated ANP)
      - Can present with embolic phenomena or right sided HF
      - Predisposing factors: Mitral pathology, hypertension, CAD (typically only in MI / CHF), PE / lung disease, hyperthyroidism, cardiac surgery, family history.
      - Precipitants: Exercise, emotion, alcohol (Holiday heart). Notably no evidence for caffeine.
    - Physical:
      - Irregular pulse, irregular JVP, variations in S1 intensity. S4 will not be present.
      - Apical-radial pulse deficits (apical ventricular rate > radial because some percentage of cycles will have short enough diastoles that pressure wave will fail to transmit; similarly some automated BP can be unreliable because of variation in Korotkoff sounds; Sapira recommends averaging 3 measurements
  - EKG characteristics
    - Narrow vs wide
    - F waves. Don’t call them P waves
    - LVH, LAA can be detected as predisposing abnormalities
  - Transthoracic Echo
    - Left atrial diameter, LVH, mitral pathology can be detected as predisposing abnormalities
Classification: (ACC / AHA / ESC)

- First detected
- Paroxysmal (recurrent >= 2 episodes that terminates in < 7 days, usually < 24 hrs)
- Persistent: AF that does not terminate within 7 days. Progression from paroxysmal to persistent / permanent is > 50% over 10 yrs despite antiarrhythmics
- Long-standing persistent (> 1yr)
- Permanent: Arbitrary point of persistent AF at which we give up on rhythm control

Long-term outcomes and management

- Anticoagulation
  - Stroke risk: CHADS2, CHADS-VASC (TABLES)
    - CHADS2: CHF (past or present), HTN (rx or un-rx), age >= 75, DM, all 1 point. Prior stroke = 2
      - 0 = no rx, 1 = A/C or ASA, favoring A/C, 2+ = AC
    - CHADS-VASC (CHA2DS2-VASC): CHF / LVEF < 35, HTN, Age (65-74 or 75+), DM, Stroke, vascular disease (MI, PAD, aortic plaque), male gender
      - 0 = no rx
      - 1 = weak recommendation for oral A/C, over ASA (per ESC guidelines)
      - 2+ = A/C
  - ASA vs warfarin vs newer agents
    - ASA: Weak evidence base. Not clearly superior to placebo and clearly inferior to warfarin. No data for using 325 over 81
    - Warfarin
    - Dabigatran: Studied in RE-LY trial
      - PO BID
      - No INR checks
      - Not approved for valvular AF
      - Contraindications: Valvular disease, bleeding diathesis, GI bleed within 12 mos, recent or planned surgery, active liver disease, CrCl < 30
      - Outcomes:
        - Rate vs rhythm control
          - AFFIRM / AF-CHF
          - Rhythm control, compelling indications: symptoms / functional status
            - Atrial kick contribution to CO
    - Agents (TABLE? Possibly advanced appendix?)
      - Ablation
      - Lasso, etc.

Acute management
Goals / when to rate control: RACE-2 trial
Agent selection / escalation
Cardioversion
  Chemical vs electric
  A/C before vs. TEE, + A/C after

Board questions

Sources:
  - Ablation not sig different than antiarrhythmics @ 2 yrs: DOI: 10.1056/NEJMo1113566
  - Clinical practice: Newly Dx AFIB: DOI: 10.1056/NEJMcp041956
  - CHADS VASC: doi: 10.1378/chest.09-1584

Personal review:

Narrow Complex Tachycardia: Diagnosis and Management

  - Many subtypes and fine-detail distinctions, but practically speaking only 3 significant mechanisms and 8 major arrhythmias:
    - Increased Automaticity
      - Sinus tachycardia
      - Junctional tachycardia
      - MAT
    - Micro-reentry
      - Atrial Tachycardia
      - AVNRT
    - Macro-reentry
      - AVRT
      - Atrial flutter
      - Atrial fibrillation
    - Insert ladder diagram and anatomic drawing here
- Types:

<table>
<thead>
<tr>
<th>Arrhythmia</th>
<th>Underlying Cause</th>
<th>Regularity</th>
<th>Rate</th>
<th>Onset</th>
<th>Atrial Activity and P-QRS Relationship</th>
<th>Response to Adenosine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sinus Tachycardia</td>
<td>Many</td>
<td>Regular</td>
<td>220-240</td>
<td>Gradual</td>
<td>P before every QRS</td>
<td>Transient slowing</td>
</tr>
<tr>
<td>Junctional Tachycardia</td>
<td>AMI, Digoxin, myocarditis</td>
<td>Regular</td>
<td>60-130 &lt; 100 = ATR</td>
<td>Gradual</td>
<td>Variable; often no relationship</td>
<td>Variable</td>
</tr>
<tr>
<td>MAT</td>
<td>Pulmonary disease, theophylline</td>
<td>Irregular</td>
<td>100-150</td>
<td>Gradual</td>
<td>At least 3 P morphologies, variable PR</td>
<td>None</td>
</tr>
<tr>
<td>Atrial Tachycardia</td>
<td>Digoxin, cardiac disease, pulmonary disease</td>
<td>Regular</td>
<td>150-250</td>
<td>Sudden</td>
<td>P before every QRS</td>
<td>60-80% terminate</td>
</tr>
<tr>
<td>AVNRT</td>
<td>AV Nodal conduction heterogeneity</td>
<td>Regular</td>
<td>150-250</td>
<td>Sudden</td>
<td>Either no visible P waves or obscured as an R' in late phase of QRS</td>
<td>Termination</td>
</tr>
<tr>
<td>AVRT</td>
<td>Persistent AV accessory pathway</td>
<td>Regular</td>
<td>150-250</td>
<td>Sudden</td>
<td>Variable; can have visible P after QRS or can have independent atrial rhythm</td>
<td>Termination</td>
</tr>
<tr>
<td>A Flutter</td>
<td>Cardiac Disease</td>
<td>Usually Regular</td>
<td>150 (2:1 block)</td>
<td>Sudden</td>
<td>Viable as intermittently conducted flutter (f) waves</td>
<td>Transient increase in block</td>
</tr>
<tr>
<td>A Fib</td>
<td>Cardiac / Pulmonary disease, PE, hyperthyroidism, post-operative</td>
<td>Irregular</td>
<td>100-220</td>
<td>Variable</td>
<td>Can be coarse or fine fibrillatory (f) waves</td>
<td>Transient increase in block</td>
</tr>
</tbody>
</table>

- Management (in progress)
  - Triage and stabilization supersede pondering the EKG.
  - Check for presence of a pulse. If pulseless, stop thinking about the EKG and manage as PEA.
Check full vitals and evaluate patient. If hemodynamically unstable or showing signs of poor perfusion and they have a narrow complex tachycardia that is not compPELLingly sinus, get ready for urgent chemical or electrical cardioversion. If sinus and hemodynamically unstable, remember that most sinus tachycardia is a secondary phenomenon, and most therapy should be directed at the underlying disorder.

If stable, can pursue further evaluation.

- Vagal maneuvers / Adenosine:
  - Vagal maneuvers: Probably too difficult to explain expiring against a closed glottis to a patient panicked from the commotion their SVT has caused, and “bear down like you’re having a bowel movement” is fraught with its own risks. Carotid sinus massage likely the best solution, but be cautious in elderly patients.
  - Overall adenosine more reliable. Note that adenosine has an extremely short half life, and if you infuse it too slowly, it won’t have any significant effect. Have a 3 way stopcock with 2 10 cc saline flushes in hand to rapidly flush after the injection of the adenosine.

- Typical algorithm:
  - 6 mg adenosine via peripheral IV, followed by 12 mg if that fails to produce an effect.
  - Use 3 mg if administering via central line or if patient has a history of a cardiac transplant.
  - Avoid if patient has a history of bronchospastic lung disease.

- Avoid both vagal maneuvers and adenosine if patient in A Fib any suspicion present for pre-excitation / WPW (increase in AV nodal blockade can paradoxically worsen ventricular rate).

- Diagnostic algorithm for stable patients:
• Examples: For now, courtesy of Wave Maven
  (http://ecg.bidmc.harvard.edu/maven/mavenmain.asp)
• Wave Maven 7, 238, 149, 23, 106, 145, 188
  ○ Sinus tachycardia (Wave Maven #238)
  ○ Junctional tachycardia
    (http://www.heartrhythmguide.com/rhythms/junctional_tachycardia.php)
  ○ MAT (Wave Maven #149)
  ○ Atrial Tachycardia (Wave Maven #23)
  ○ AVNRT (Wave Maven # 7)
  ○ AVRT (Wave Maven #106)
  ○ Atrial flutter (Wave Maven #188)
  ○ Atrial fibrillation (Wave Maven #145)