Atrial Fibrillation with Rapid Ventricular Rate

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1. Pathophysiology:
    - Atrial fibrillation (afib) originates in the atrial chambers or from pulmonary veins as:
        - Ectopic foci
        - Single circuit re-entry
        - Multiple circuit re-entry
    - Atrial rate can be up to 400 beats/min
    - AV node regulates ventricular rate through its refractory period
        - RVR = ventricular rate is > 100 bmp
        - But you can have slow (HR < 60 bmp) or controlled (HR 60-100 bpm) ventricular rates
2. EKG findings of afib:
    - Narrow QRS (< 120ms)
    - Irregularly irregular ventricular rate
        - HR = (# QRS complexes in 10 second strip) x 6
        - Usually the threshold to treat in the hospital setting is HR > 110
    - No discernable P waves
3. Etiology and Evaluation
    - Cardiac:
        - Structural/valvular heart disease
            - Obtain TTE
        - ADHF
            - BNP, volume overloaded on exam, history
        - Ischemia
            - EKG, troponins, history
    - Non-cardiac:
        - Pulmonary disease/OSA
            - CXR, sleep study
        - Thyrotoxicosis
            - TSH w/reflex
        - Drug intoxication:
            - Urine toxicology to evaluation for stimulants (cocaine, methamphetamines)
        - Metabolic derangements
            - CMP
4. Management:

- If unstable, (defined below), use synchronized cardioversion 120-220J followed by anticoagulation
    - sustained SBP < 90 with lightheadedness, altered mental status, chest pain, or SOB
    - signs of ACS (chest pain, elevated troponins, EKG changes)
    - signs of acute heart failure (respiratory distress, pulmonary edema)
- If stable, treatment depends on HR:
    - If HR > 130, start with IV meds
        - IV metoprolol 5mg over 2 minutes every 5 minutes (up to 15mg) or IV esmolol
            - Use is limited if patient is hypotensive
            - Avoid in decompensated HFrEF or severe asthmatics
        - IV diltiazem 0.25mg/kg bolus (max 25mg) followed by infusion 5-15mg/hr
            - Use is limited if patient is hypotensive
            - Avoid in HFrEF (even if not acutely decompensated)
        - IV digoxin 0.25 mg every 4-6 hrs up to 1 mg
            - Caution with renal failure
            - Good option if pt is hypotensive
        - IV amiodarone 150mg bolus followed by 1mg/minute x 6 hours and 0.5mg/minute x 18 hours
            - Caution in chronic afib as this can chemically cardiovert patient (risk for clot embolization), unless pt is confirmed to have been on and compliant with anticoagulation
    - If HR < 130 or once in NSR after treating with IV, can treat with PO meds
        - PO metoprolol (titrate as needed 12.5-50mg q6h)
        - PO diltiazem 120-480 mg daily
        - PO amiodarone 400mg BID (until finishing 10g load), then 200mg daily
        - PO digoxin 0.125-0.25 mg daily

5. Clinical pearls:
    1. When assessing for afib with RVR, determine if the patient is stable. If unstable, you should cardiovert the patient.
    2. Beta-blockers and calcium channel blockers are first line to treat afib.