ECG Workshop

Jared W Magnani, MD, MSc
University of Pittsburgh
UPMC Heart and Vascular Institute
Pittsburgh, PA
March 24, 2017
Overview and Objectives

• Review a differential for supraventricular tachycardia
• Identify and localize ischemia and injury on the ECG
• Recognize electrolyte abnormalities on the ECG
• Examine left ventricular hypertrophy and its diagnosis by ECG
• Identify and categorize heart block and conduction disease
• Conclusions and resources
What is the diagnosis? What is your differential?
Case 1

- 26 year old woman
- Diagnosed with anxiety at age 19
- Treated with SSRI and CBT
- No improvement; anxiety episodes seem to be getting worse
- Episode in your office; heart rate 160 bpm
What is the diagnosis? What is your differential?

Short R-P Tachycardia
AV Nodal Re-entrant Tachycardia (AVNRT)

Pathophysiology

Treatment
- Block AV node
- Adenosine
- Vagal maneuvers
- Ablation (EP study)
Case 2

- 68 year old man
- Hypertension, obesity, DM, sleep-disordered breathing, all well managed by you
- Feels more fatigued, felt dyspneic walking into office
- Vague complaints (resident says, “poor historian”)
- Is an ECG indicated?
- On exam, irregular pulse
Prevalence of Atrial Fibrillation
The Anticoagulation and Risk Factors in AF Study
(Kaiser Permanente)

At age 60+, 
1 in 25
Americans have AFib

At age 80+, this increases to nearly
1 in 10
Americans have AFib (Go 2001)

Go et al. JAMA 2001;285:2370
Atrial Fibrillation – Highly Prevalent

- Men: 26%
- Women: 23%

Lloyd-Jones, Circulation 2004;110:1042
Management?

a. Cardiovert in office
b. Refer to emergency room
c. Start Xarelto (rivaroxaban)
d. Start metoprolol
e. C and D

Guidelines suggest

a. Evaluate for underlying cause
b. Evaluate for stroke risk
c. Rate control
d. Anticoagulation, shared decision-making
e. Cardiology referral based on your comfort
Case 3

- 68 year old man
- Hypertension, obesity, DM, sleep-disordered breathing, all well managed by you
- Feels more fatigued, felt dyspneic walking into office
- Vague complaints (resident says, “poor historian”)
- Is an ECG indicated?
- On exam, regular pulse
Diagnosis?  Typical atrial flutter

Sawtooth pattern; stereotyped A-V
Case 4

• 75 year old woman
• History of hypothyroidism, stable replacement
• Professor of biochemistry
• Stopped class because of dizziness, rapid heart beat
• Episodes up to 30 mins
• On exam, regular pulse
Diagnosis?  Atrial Tachycardia

[ECG waveform diagram with annotations]
Supraventricular tachycardia – What is your differential?

• Sinus tachycardia
• Atrioventricular nodal re-entry tachycardia (AVNRT)
• Atrioventricular re-entry tachycardia (AVRT)
• Atrial fibrillation (common)
• Atrial flutter
• Atrial tachycardia
• Multifocal atrial tachycardia (rare)
Case 5

- 23 year old woman
- No past medical history
- “Yes, I do have chest pains sometimes”
ECG – 23 yo M

HR 54bpm

21:56.40

Sinus bradycardia

Otherwise normal ECG **Unconfirmed**

Name: 12-Lead 1

ID: PR 0.142s

Patient ID: QRS 0.098s

Incident ID: 0.398s/0.377s

Age: 27 Sex: P-QRS-T Axes: 20° 18° 41°
Case 6

- 48 year old man
- Works in deliveries
- “Yes, I do have chest pains sometimes”
What’s wrong here?
Ventricular Bigeminy
Coronary blood supply to the cardiac conduction system
Evolution of Acute MI
Case 7

• 32 year old man
• Does some construction
• Started smoking at age 13
• Sore, itchy throat; generalized pains; episodes 5-10 mins
• No chest pain or discomfort
• Thinks seasonal allergies
• PE normal; one episode of discomfort in exam room, keeps changing positions; resolves
Case 7, continued

- 32 year old man
- Sore, itchy throat; generalized pains; episodes 5-10 mins
- No chest pain or discomfort
- Cardiology: “It’s not a STEMI. The patient is too young.”
- Troponin positive ➔ catheterization
Post-catheterization & PCI
The Next Day
Case 8

- 52 year old man
- Does some construction
- Started smoking at age 13
- Sore, itchy throat; generalized pains; episodes 5-10 mins
- No chest pain or discomfort
- Thinks seasonal allergies
- PE normal; one episode of discomfort in exam room, keeps changing positions; resolves
Case 8 – What is your differential?
Case 8 – What is your differential?
Case 9

- 17 year old male
- Healthy and no medications
- Syncope on the basketball court
- “Sometimes it feels like my heart is racing”
- PE normal
Accessory Pathway

Normal electrical pathways

Abnormal electrical pathway in Wolff-Parkinson-White syndrome
Case 10

• 17 year old male
• Healthy and no medications
• Syncope on the basketball court
• “Sometimes it feels like my heart is racing”
• PE normal
Case 10 – during tachycardia
Case 10 – after adenosine 6 mg IV
Case 11

- 47 year old male
- Healthy and no medications
- Syncope on the basketball court
- “Sometimes it feels like my heart is racing”
- PE normal
Case 11 – during tachycardia, AF
Case 12

- 17 year old male
- Healthy and no medications
- Syncope on the basketball court
- “Sometimes it feels like my heart is racing”
- PE normal
Case 12 – We should never miss this one
Case 12b – *Never miss this one either*
Case 13

- 77 year old male
- Well-controlled hypertension; distant history of coronary disease
- Older adult, vitals normal
- On metoprolol, amlodipine, ASA, several other medications
- “I might be slowing down”
First degree AV block

1\textsuperscript{st} Degree AV-block: benign or not?
Case 14

- 77 year old male
- Well-controlled hypertension; distant history of coronary disease
- Older adult, vitals normal
- On metoprolol, amlodipine, ASA, several other medications
- “I might be slowing down”
Case 15

- 77 year old male
- Well-controlled hypertension; distant history of coronary disease
- Older adult, vitals normal
- Taken off metoprolol, amlodipine; remains on ASA, several other medications
- “I am slowing down”
Case 15 – 2\textsuperscript{nd} degree AV block, type 1 or 2?

Type 1 or Type 2?
- 2:1, we can’t tell
- RBBB here \(\rightarrow\) conduction disease
- P-P around QRS shorter
Case 16

- 70 year old woman
- Well-controlled hypertension; distant history of coronary disease
- Older adult, vitals normal
- Fatigued
- On exam, HR 60, BP 190/100 mm Hg
Case 16 – 2\textsuperscript{nd} degree AV block, type 1 or 2?
Case 17

- 78 year old man
- Well-controlled hypertension; distant history of coronary disease
- Older adult, vitals normal
- Tripped at home
Case 17

Regular P-P

Regular R-R
Case 18

• 43 year old woman
• History of depression, reflux
• Treated with citalopram, omeprazole
• Developed otitis; received erythromycin
• Tripped at home: “felt like I almost blacked out”
Case 18 – How long is too long?
Case 18 – QT prolongation

• 43 year old woman
• Iatrogenic QT prolongation – more common than long QT syndromes
• QT syndromes: if in doubt, refer to EP
• Watch for multiple agents → QT pile up
Case 18
Thank you

• Questions?
• What do you want different next year? (feedback is a gift, please give generously to trainees, colleagues, mentees, me)

Jared W Magnani, MD, MSc
magnanij@pitt.edu