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EKG and Rhythm Interpretation 101

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Objectives

- Patients who should get an EKG
- Reading an EKG
- Identifying ST elevation MI
- Atrial arrhythmias
- Nodal Blocks
- Ventricular arrhythmias
- ACLS algorithms
Who should get and EKG?

Possible diagnoses of:
- Acute coronary Syndrome
- Myocardial Infarction
- Syncope
- Stroke
- Arrhythmia
- Hyperkalemia (includes renal failure)
- Overdose
- Other electrolyte abnormalities
Approach to reading EKGs

- Multiple ways to read EKGs
- Do it the same each time
- Rate, Rhythm, Intervals, Abnormalities
  - Precordium
  - Territories
Normal EKG:
Electrical Anatomy

http://doctorgrashopper.wordpress.com/tag/ekg/

http://www.brighamandwomens.org/Departments_and_Services/medicine/services/cvcenter/Patient/pacemaker.aspx
Basics:

- **Rate** (< 60 Bradycardia, >100 Tachycardia):
  - Find a QRS on a big box
  - Count down: 300, 150, 100, 75, 60, slow...

- **Rhythm**
  - Is there a p before every QRS? Yes → NSR

http://www.learntheheart.com/Normal.jpg
Intervals

- PR = 0.12 – 0.20 ms, 3–5 small boxes
  - Corresponds to conduction from SA to AV node

- QRS < 0.12 ms, 3 small boxes
  - Conduction through ventricular system

http://www.learntheheart.com/Normal.jpg
Limb leads and Precordial leads

Figure 17-42 Electrocardiographic views of the heart.

http://allaboutim.webs.com/apps/blog/show/next?from_id=5380740
Lateral Leads

http://www.learntheheart.com/Normal.jpg
Inferior Leads

http://www.learntheheart.com/Normal.jpg
ST Segments

- Inline with baseline
- Elevation:
  - 3mm in precordial leads or 1mm in limb leads
  - Early repolarization vs. pericarditis vs. STEMI

- Depression
  - One small box below baseline
  - Ischemia, reciprocal changes
Early Repolatization

http://www.learntheheart.com/Normal.jpg
Pericarditis
Monitor, ABCs
ASA, Oxygen if needed, NGT, morphine if needed
12-Lead EKG if possible and notify hospital if STEMI

STEMI or new LBBB $\rightarrow$ cath lab door to balloon time < 90 min!

To hospital for further care but not immediate cath lab
Tachycardia

- Atrial
- Ventricular

Source undetermined
Atrial Tachy-arrhythmias

- Originate above AV node
- Produce narrow QRS complexes
- Afib: Irregularly irregular
- Aflutter: Regularly irregular, usually 2:1 conduction (rate 150)
  - Afib/flutter often seen with respiratory problems
  - COPD/Asthma, PE
- SVT: regular, fast, narrow complex, no visible p waves
  - Drugs, electrolyte imbalance, bad wiring
Afib with RVR
Aflutter
SVT

http://www.emedu.org/ecn/crapsanyall.php
Ventricular Tachycardia

- Originates below AV node
- Wide complex
Airway Oxygen (if hypoxic) Monitor

Unstable? Cardioversion
Adenosine: narrow and wide and regular
-6mg IV push
-12mg second dose

American Heart Association
AV Blocks

- 1\textsuperscript{st} degree: prolonged PR > 220ms (one big box)
2nd degree AV block: Type 1

- PR interval progressively longer until it doesn’t conduct
- Stable, no intervention usually needed
Consistent PR interval
P that doesn’t conduct
Sign of conduction problem below the AV node
Can progress to 3\textsuperscript{rd} degree block (bad)
3\textsuperscript{rd} degree block

- Complete dysfunction of AV node
- Atria and ventricles not communicating
Treatment

- IV, O2, Monitor
- Transport
- 3rd degree block + unstable
  - May need to pace
- Atropine?
- May not work given A–V dissociation

- Definitive treatment: Pacemaker
Bradycardia

Other causes:
- Sinus node dysfunction
- Heart attack
- Medications
- Electrolyte abnormalities
- Hypothermia
Assess, typically < 50 BPM

Identify and treat underlying condition.
- Maintain airway and assist breathing if necessary
- Oxygen (if hypoxemic)
- Monitor
- IV access
- 12-Lead EKG, do not delay treatment if not available
Persistent Bradycardia causing:
- Hypotension
- Acutely altered mental status
- Signs of shock
- Ischemic chest discomfort
- Acute heart failure

Atropine
If ineffective:
- Pacing or Dopamine or Epi

Dosing:
Atropine: 0.5 mg IV. Can repeat Q3–5 min. Max 3mg
Dopamine: 2–10 mcg/kg/min drip
Epi: 2–10 mcg/min drip
Bradycardia and Tachycardia

- Determine if
  - *Unstable*: vital organ function is impaired, or impending cardiac arrest
    - Altered mental status, acute heart failure, hypotension
  - *Symptomatic*: lightheadedness or dizziness
- If a person is symptomatic but stable, have more time
- If unstable have to intervene
- Determine cause of instability and treat underlying cause
Ventricular arrhythmias

- Right Bundle Branch Block
- Left Bundle Branch Block
- Premature Ventricular Contractions (PVCs)
- Ventricular Tachycardia
- Ventricular Fibrillation
- Torsade de Points
RBBB

- QRS > 120 ms (3 small boxes)
- rsR’ – “bunny ears” in precordial leads
- Slurred s waves in I, V5, V6
LBBB

- WRS > 120ms (3 small boxes)
- No Q waves in I, V5, V6
- Monomorphic R wave in I, V5, V6
- ST and T waves are in opposite direction than QRS complex
  - Discordance
LBBB

Source undetermined
A new LBBB + symptoms of ischemic heart disease = Acute MI until proven otherwise
- Chest pain
- Syncope
- Shortness of breath
- Nausea/vomiting
- Diaphoresis

MI in old LBBB
- If discordance is broken (QRS and ST–T waves are in the SAME direction) BE CONCERNED!
MI in LBBB
PVCs

- Occur before you would expect another beat
- Wide complex – originate below AV node
- Pause after before the next
- Patients can feel “flip-flop” in chest or a skipped beat
PVCs
PVCs gone bad

Source undetermined
Vtach and Vfib

- VT can have a pulse $\rightarrow$ tachycardia algorithm
- Pulses VT or VF $\rightarrow$ Cardiac Arrest algorithm
Torsades de Points

- “Twisting around a point”
- Type of ventricular fibrillation
- Electrolyte imbalances (Magnesium)
- Electrical Abnormalities (Prolonged QT)
- Give Mag
PEA

- Pulseless electrical Activity
- Any wave form **without** a pulse
Asystole

- “Flatline”
- No cardiac activity
- No ventricular depolarization
# Cardiac Arrest: Treatable Causes

<table>
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<th><strong>5Hs</strong></th>
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<td>Hypothermia</td>
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</table>
CPR: push hard and fast
  - ≥2 inches, ≥100/min
Minimize interruptions
Avoid excessive ventilation
Change compressors every 2 min
30:2 ratio if no advanced airway
Biphasic: manufacturer recommendation (120–200J), if unknown use maximal dose
Monophasic: 360J

Epi (IV/IO): 1mg (1:10,000) Q3–5min
Advanced airway: King tube or ETT

Amio (IV/IO): First dose 300mg
Second dose 150mg

If at any point rhythm become unshockable go to asystole pathway
Once advanced airway is placed
100 compression/min
No pauses for ventilation
56 yo male with chronic renal failure presenting with fatigue
- Hyperkalemia
- 2-3 degree heart block, wide complex tachycardias, progression to vf and asystole
- 6.5-7.5 peaked t waves
- 7.5-8.0 widening of the qrs
- 10-12 sine wave, vf, asystole
22 yo female with prolonged vomiting
- Small or absent t waves
- Prominent U waves
- First or second degree AV block
- Slight ST depression
14 yo female, no pmh, presenting with seizure. Mother has a history of depression.
Sodium channel blocker: includes la arrhythmias (quinidine, procainamide)
IC antiarrhythmias: flecainide, encainide
Local anesthetics: bupivacaine
Antimalarias: chloroquine, hydroxychloroquin
Dextropropoxyphene
Propranolol
Carbamazepine
Quinine

Seizures, and ventricular arrhythmias

Ekg: intraventricular conduction delay QRS >100ms in lead II
Right axis deviation, terminal r wave in aVR

QRS greater than 100ms predictive of seizures, > 160 predictive of VT

Clinical management: IV, monitor O2
IV sodium bicarb 100meq, repeat every few minutes until QRS narrows
Intubate: hyperventillate ph 7.5
Seizures: IV benzos
Hypotension: crystalloid, vasopressors (norepi)
Arrhythmias: bicarb, lidocaine if necessary