Project: Ghana Emergency Medicine Collaborative

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Author(s): Emily Sagalyn (University of Utah), MD 2012

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EKG and Rhythm Interpretation 101

Emily Sagalyn, MD Wilderness/EMS Fellow University of Utah

Objectives

- Patients who should get an EKG
- Reading an EKG
- Identifying ST elevation MI
- Atrial arrythmias
- Nodal Blocks
- Ventricular arrythmias
- ACLS algorithms

Who should get and EKG?

- Possible diagoses of:
 - Acute coronary Syndrome
 - Myocardial Infarction
 - Syncope
 - Stroke
 - Arrythmia
 - 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:



http://www.learntheheart.com/Normal.jpgc

Electrical Anatomy



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



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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 \rightarrow NSR

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</p>
 - Conduction through ventricular system



Limb leads and Precordial leads



Figure 17-42 Electrocardiographic views of the heart.

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

Lateral Leads





Inferior Leads



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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



Pericarditis



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

STEMI



Further reading: http://blog.thealo.com/thealo/blog/post/2009/07/31/STEMI-Pericarditis-Early-Repolarization.aspx



Tachycardia

- Atrial
- Ventricular



Source undetermined

Atrial Tachy-arrythmias

Sinus Node Right Atrium AV Node Right Ventricle Conduction Pathways

- Originate above AV node
- Produce narrow QRS complexes
- Afib: Irregularly irregular
- Aflutter: Regularly irregular, usually 2:1 condution (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









http://www.emedu.org/ecg/crapsanyall.php

Ventricular Tachycardia

Originates below AV node

Wide complex



ACLS Tachycardia Algorithm



AV Blocks

1st degree: prolonged PR > 220ms (one big box)



Source undetermined

2nd degree AV block: Type 1

- PR interval progressively longer until it doesn't conduct
- Stable, no intervention usually needed



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2nd degree AV Block: Type 2

- Consistent PR interval
- P that doesn't conduct
- Sign of conduction problem below the AV node
- Can progress to 3rd degree block (bad)



3rd 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

ACLS Bradycardia algorithm



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

ACLS Bradycardia algorithm



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: 2-10mcg/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 of 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 arrythmias

- 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

LBBB

- 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 → tachycardia algorithm
 Pulses VT or VF → Cardiac Arrest algorithm



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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

5Hs	5Ts	
 Hypovolemia Hypoxia Hydrogen ions (Acidosis) Hypo-/hyperkalemia 	 Tension pneumothorax Tamponade (cardiac) Toxins Thrombosis (pulmonary) Thrombosis (coronary) 	

Hypothermia

ACLS Cardiac Arrest Algorithm

- CPR: push hard and fast
 - \geq 2 inches, \geq 100/min
- Minimize interruptions
- Avoid excessive ventillation
- Change compressors every 2 min
- 30:2 ratio if no advanced airway



Adult Cardiac Arrest



Adult Cardiac Arrest



Once advanced airway is placed 100 compression/min No pauses for ventillation

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 arrythmias (quinidine, procainamide)
- IC antiarrythmias: flecainide, encainide
- Local anesthetics: bupivacaine
- Antimalarias: chloroquine, hydroxychloroquin
- Dextropropoxyphene
- Propranolol
- Carbamazepine
- Quinine
- Seizures, and ventricular arrythmias
- 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, repeart every few mintues until QRS narrows
- Intubate: hyperventillate ph 7.5

- Seizures: IV benzos
- Hypotension: crystalloid, vasopressors (norepi)
- Arrythmias: bicarb, lidocaine if necessary