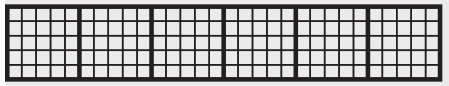
RATE

300 150 100 75 60 50 43

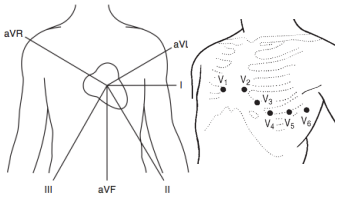


NORMAL SINUS RHYTHM

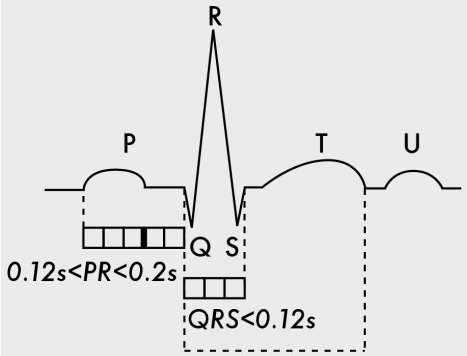
- Is there a P wave for every QRS?
- Is there a QRS for every P wave?
- P wave upright in lead II and inverted in lead aVR?

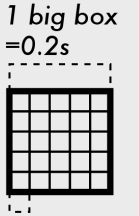
AXIS DEVIATION

AXIS DEVIATION	Lead I QRS	Lead II/aVF QRS
Normal	+	+
Left	+	-
Right	-	+

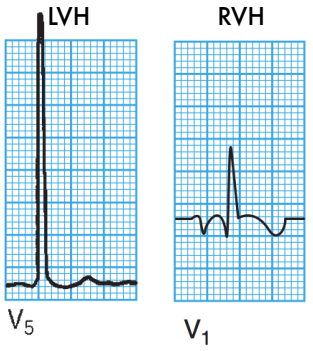


INTERVALS





	1-15yo	M	W
Normal	0.44	<0.43	<0.45
Prolonged (upper 1%)	>0.46	>0.45	>0.47



HYPERTROPHY

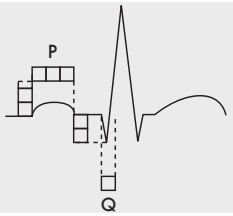
- LVH
  - R wave in V5 or V6 >25mm
  - S wave in V1 or V2 >25mm
  - Sum of R wave in V5 or V6 + S wave in V1 >35mm
- RVH
  - R wave > S wave in V1
- LEFT ATRIAL ENLARGEMENT (P mitrale)
  - P wave > 0.12s (3 small squares) and bifid in lead II
- RIGHT ATRIAL ENLARGEMENT (P pulmonale)
  - P wave > 0.25mV (2.5 small squares) in lead II

Q WAVES

- Can be normal in leads aVL, I, II, V5, V6
- Can be normal on expiration in lead III

PATHOLOGICAL Q WAVES

- > 2 small squares deep
- >25% of height of following R wave in depth
- >1 small square wide



SHARP J POINT

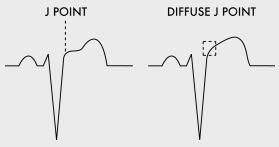
- ST seg. & T wave well demarcated, not merged as in STE

DIFFUSE J POINT

- ST slowly curving with only an area J point can be found

J POINT ELEVATION

- Normal in young, healthy athletes



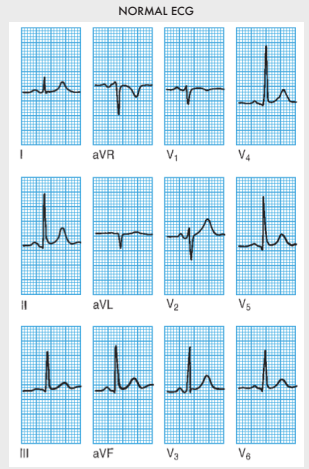
ST SEGMENT ELEVATION

- (New STE at the J point)
- In all leads (but V2-V3), significant STE =
  - In two contiguous leads
  - >1mm
- In leads V2-V3, significant STE =
  - >1.5mm in women
  - >2mm in men >40yo
  - >2.5mm in men <40yo

ST SEGMENT DEPRESSION

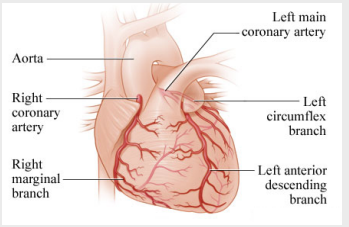
- (New horizontal or down-sloping STD)
- Significant STD =
  - In two contiguous leads
  - >0.5mm
- and/or
  - T-wave inversion >1mm in two contiguous leads with
  - Prominent R wave or R/S ratio>1

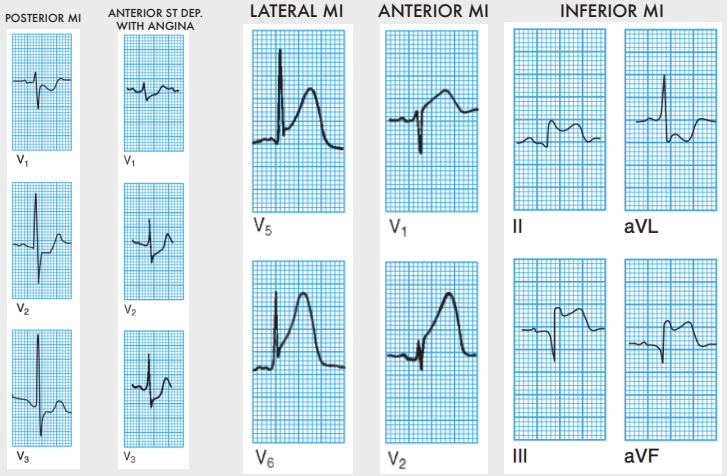
*** Known LBBB and pacing make ECG less diagnostic for ACS



PATTERNS

- Anterior MI (LAD) = V1-V4
- Lateral MI (LCx) = I, aVL, V5-V6
- Anterolateral MI (LAD) = I, aVL, V1-V6
- Inferior MI (RCA, LCx) = II, III, aVF
- Inferolateral MI (RCA, LCx) = I, aVL, V5-V6, II, III, aVF
- Acute posterior MI (RCA or LCx)
  - R waves in leads V1-V3
  - ST depression in V1-V3
  - Upright, tall T waves





TALL T WAVES

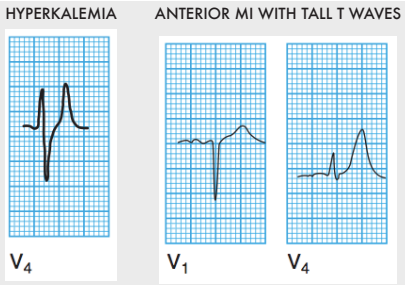
- Should be no more than 1/2 preceding QRS (as a general guide)

SMALL T WAVES

- Evaluation is subjective

INVERTED T WAVES

- Normal in leads aVR, V1
- Normal in lead V2 in young pts
- Normal in lead V3 in black pts
- Normal in lead III, absent in inspiration



DIFFERENTIAL

Short PR interval
- AV junctional rhythms
- WPW syndrome
- LGL syndrome

Long PR interval
- 1st degree AV block
- Ischemic heart disease
- Hyperkalemia
- Acute rheumatic myocarditis
- Lyme disease
- Digoxin, quinidine, BB, Ca blockers

Wide P wave
- LAE

Tall P wave
- RAE

Pathological Q waves
- STEMI
- LVH
- WPW syndrome
- BBB
- Pulmonary embolism

Large R or S waves
- LVH, RVH
- Posterior MI
- WPW syndrome
- Dextrocardia
- BBB

Small QRS complexes
- Obesity
- Emphysema
- Pericardial effusion

Wide QRS complexes
- BBB
- Ventricular rhythms
- Hyperkalemia

Abnormal shaped QRS complexes
- Incomplete BBB
- Fascicular block
- WPW syndrome

ST segment elevation
- ST segment elevation MI
- Left ventricular aneurysm
- Prinzmetal's (vasospastic) angina
- Pericarditis
- High take-off
- LBBB
- Brugada syndrome

ST segment depression
- Acute posterior MI
- Myocardial ischemia
- Drugs (digoxin, quinidine)
- Ventricular hypertrophy + 'strain'

J waves present
- Hypothermia

Diffuse J point
- Early repolarization, LVH with strain, pericarditis, acute MI

Short QTc interval
- Hereditary short QT syndromes
- Hypercalcemia
- Digoxin effect
- Hyperthermia

Long QTc interval
- Hypocalcemia
- Drugs (quinidine, procainamide, amiodarone, sotalol, flecainide, antipsychotics, TCAs, terfenadine, macrolides, quinolones)
- Acute myocarditis
- Long QT syndrome

Tall T waves
- Hypothermia
- Acute MI
- Hyperkalemia

Small T waves
- Hypokalemia
- Pericardial effusion
- Hypothyroidism

Inverted T waves
- Myocardial ischemia
- Myocardial infarction
- Ventricular hypertrophy + 'strain'
- Digoxin toxicity

Prominent U waves
- Hypokalemia
- Hypercalcemia
- Hyperthyroidism

RHYTHMS & ARRHYTHMIAS

SA nodal rhythms	
• Sinus rhythm	• P wave for q QRS, QRS for q P wave
• Sinus arrhythmia	• HR inc during inspiration
• Sinus tachycardia	• >100bpm
• Sick sinus syndrome	• dysfunction of sinus node
• Sinus bradycardia	• <60bpm
• SA block	• P fails, next P where expected
• Sinus arrest	• P fails, next P not where expected
AV blocks	
• First-degree	• long PR
• Second-degree	• non-conducted P waves
• Mobitz Type I	• progressive lengthening of PR
• Mobitz Type II	• PR constant
• Third-degree	• atria and ventricles are independent
Atrial rhythms	
• Atrial tachycardia	• >100bpm, abnormally shaped P waves
• Atrial flutter	• sawtooth P, atrial rate 300/min, AV bl.
• Atrial fibrillation	• no P waves, irregularly irregular
Ectopic beats	
• Atrial ectopic beats	• early P wave, abnormal P wave shape
• AV junctional ectopics	• early QRS, narrow QRS
• Ventricular ectopics	• early QRS, broad QRS
• Bigeminy	• ventricular ectopic follows q norm. beat
SVTs	
• AV re-entry tachycardia	• narrow QRS, inverted P, P half-buried
• AV nodal re-entry tachycardia	• narrow QRS, P buried inside QRS
Ventricular rhythms	
• Ventricular tachycardia	• broad QRS, 3+ PVCs in a row
• Accelerated idioventricular rhythm	• broad QRS, HR <120bpm
• Torsades de pointes	• broad QRS, polymorphic, long QT
• Ventricular fibrillation	• no identifiable waves, erratic
Conduction disturbances	
• Left bundle branch block	• V1: small Q, R, S; V6: R, S, R'
• Right bundle branch block	• V1: tiny R, S, R'; V6: small Q, R, S
• Bifascicular block	• left axis dev, left ant. hemiblock, RBBB
• Trifascicular block	• bifascicular block, 1st degree AV block
Escape rhythms	
• AV junctional escape rhythm	• narrow QRS, absent P, 40-60bpm
• Ventricular junct. escape rhythm	• broad QRS, absent P, 15-40bpm

ETC

Pulmonary embolism	• S in lead I, Q in III, TWI in III
Pericardial effusion	• electrical alternans: variation in R ht.
Hypokalemia	• flat T waves, U waves
Hyperkalemia	• peaked T waves, wide QRS, long PR