15 June 2017

ECG for MS4

เอกราช อริยะชัยพาณิชย์
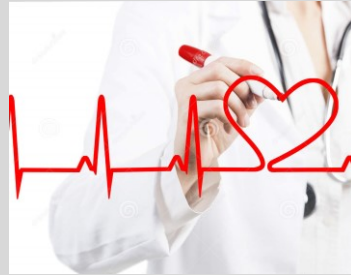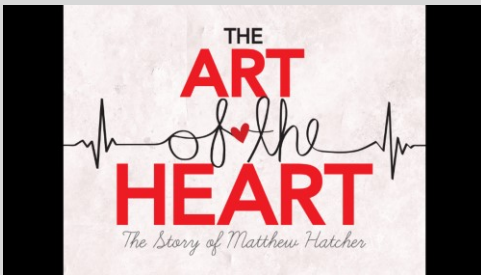
Heart Failure and Transplant Cardiology
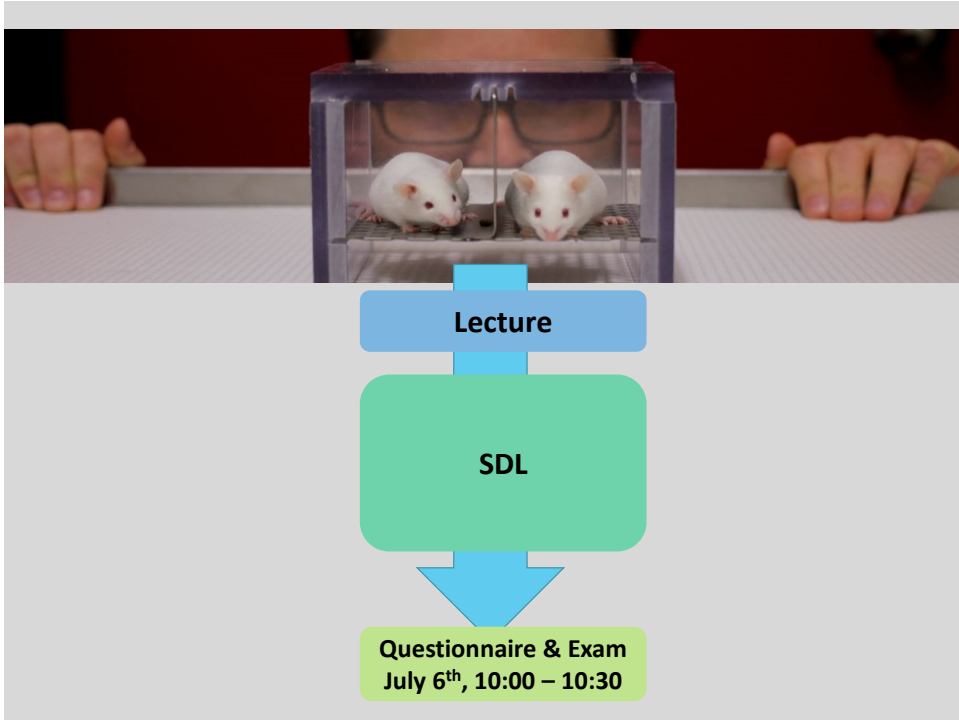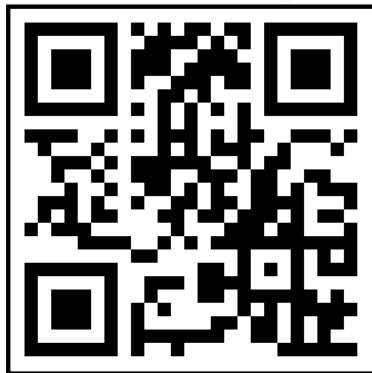
aekarach.a@chula.ac.th

Electro-cardio-gram

The picture of the heart's electricity

Lecture

SDL

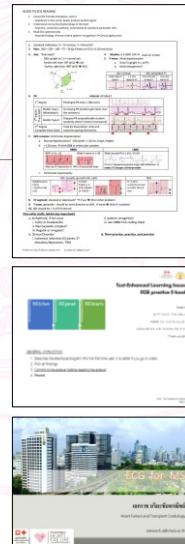Questionnaire & Exam
July 6th, 10:00 – 10:30
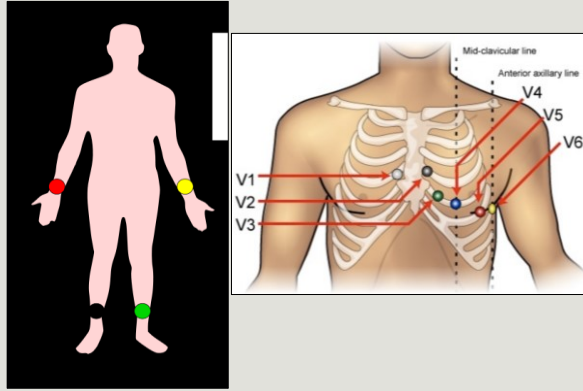
Resource
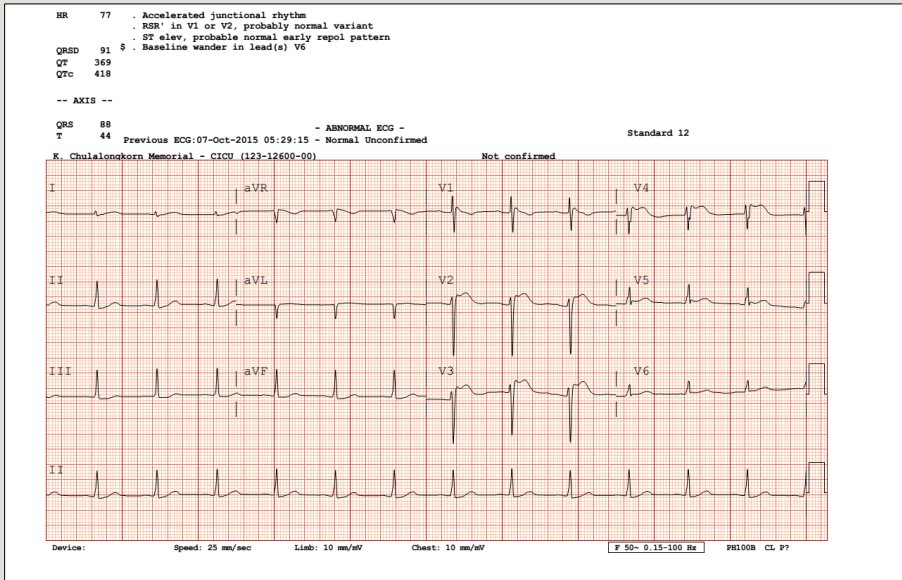

https://goo.gl/EwlywD

Hardware – machine, printer, electrode

Electrodes to patient
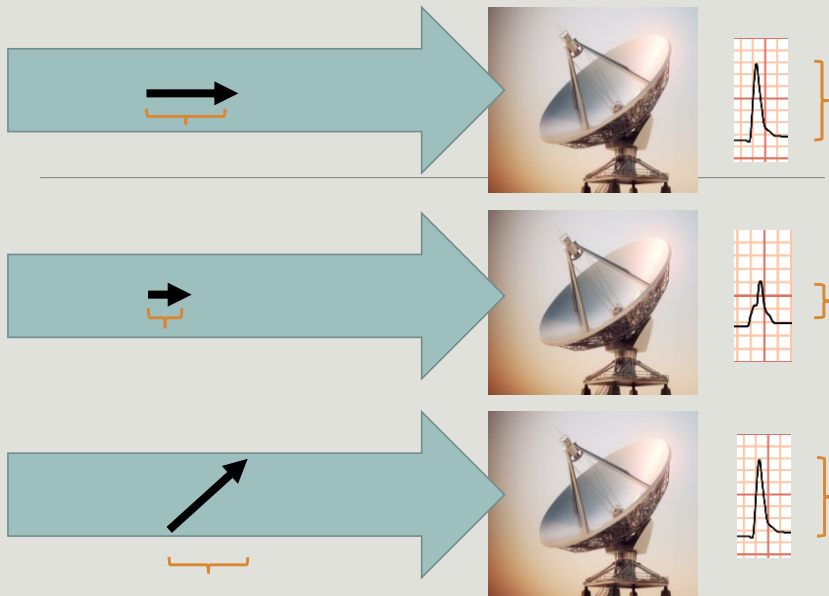

Print out graft of time vs. voltage

Antenna 1

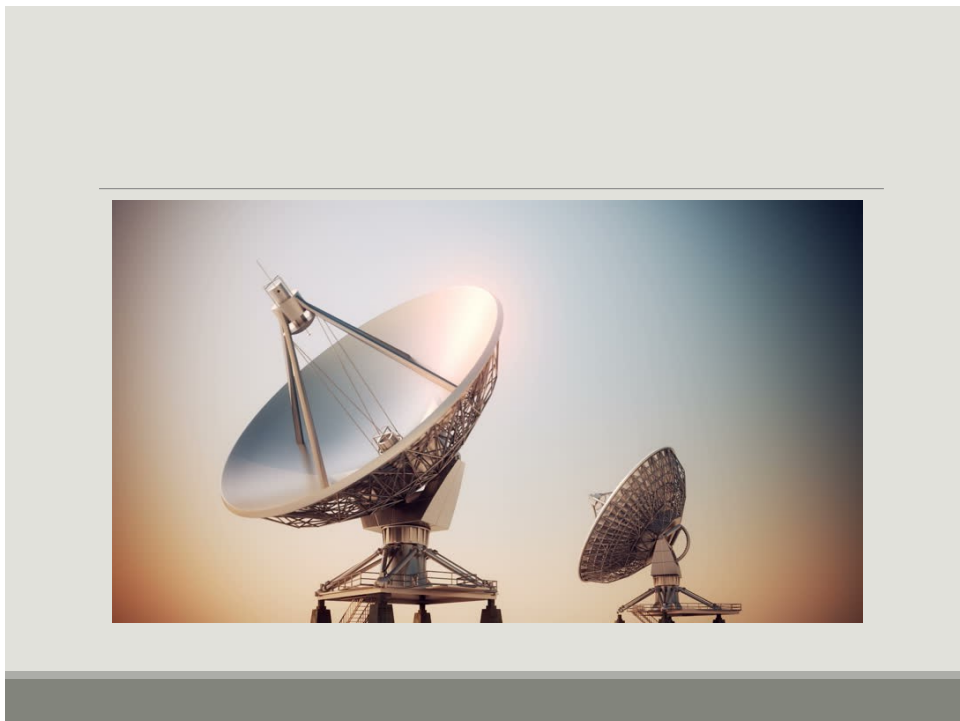Theory – Athena (looking anta signal only on that direction), signal is a vector

Theory – Athena (looking anta signal only on that direction), signal is a vector

Signal ที่ **depolarize** วิ่งเข้าหา **lead** ไหน
lead นั้นแสดงสัญญาณเป็น **positive**

Theory – Athena (looking anta signal only on that direction), signal is a vector

Test

Depolarization signal

aVF

I

I

aVF

1 2 3 4

I

III

aVF

II

Atrial rhythm

Junctional rhythm

Ventricular rhythm
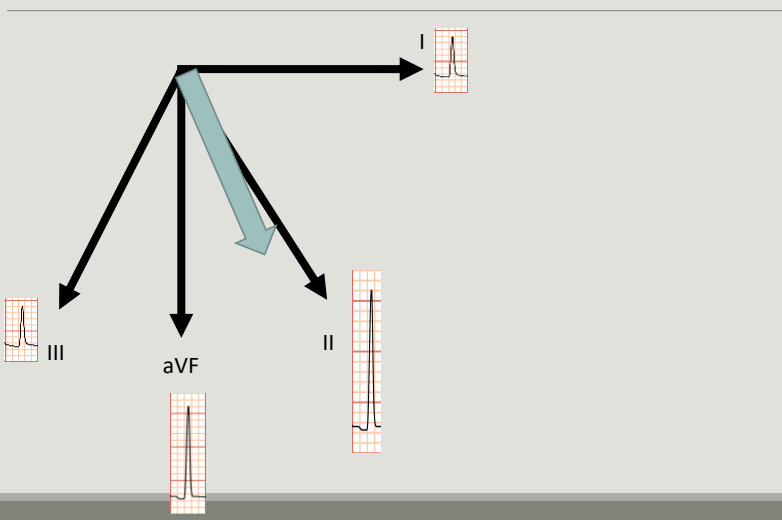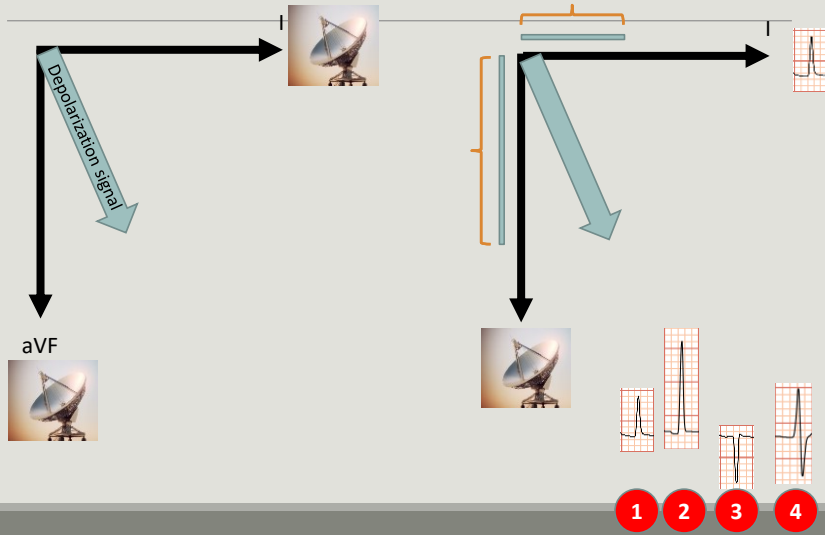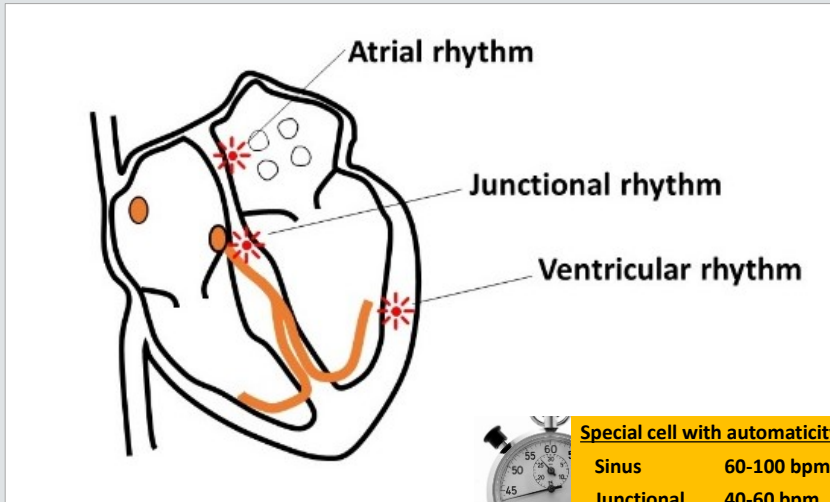
Special cell with automaticity	
Sinus	60-100 bpm
Junctional	40-60 bpm
Ventricular	20-40 bpm
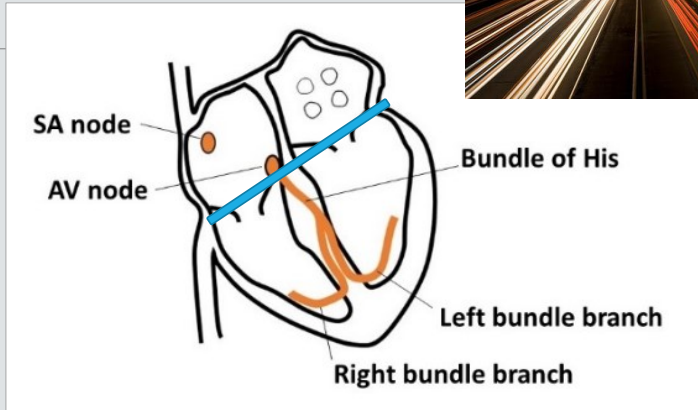
Special condpathway - SA node, AV node, His buddle, LBBB, RBBB
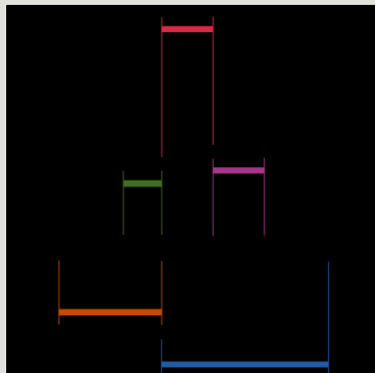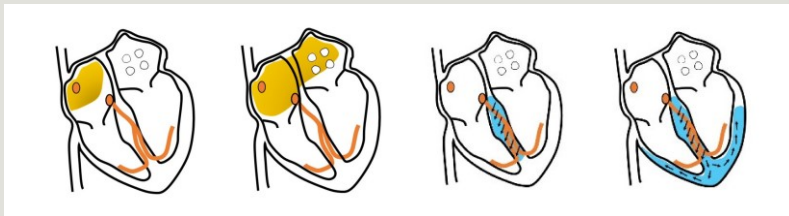
DESCRIBE	INTERPRETE	MANAGEMENT
Step-by-Step approach 1. **Calibration** 2. **Rate** 3. **Axis** 4. **Rhythm** 5. **P** 6. **PR** 7. **Q R S** 8. **ST –T** 9. **QT** 10. **ECG diagnosis**		

1. Calibration
□ Standard calibration

X axis = time, set at 25 mm/sec

Y axis = volatage gain (amplitude) set at 10 mm/mV

2. Rate
Heart rate, ventricular rate

How many times per minute?

5 big boxes = 1 sec
1 big boxes = 0.2 sec
1 small boxes = 0.04 sec

4 big boxes (0.8 s) มี 1 beats

60 seconds   = ? Beats

= 60/0.8s
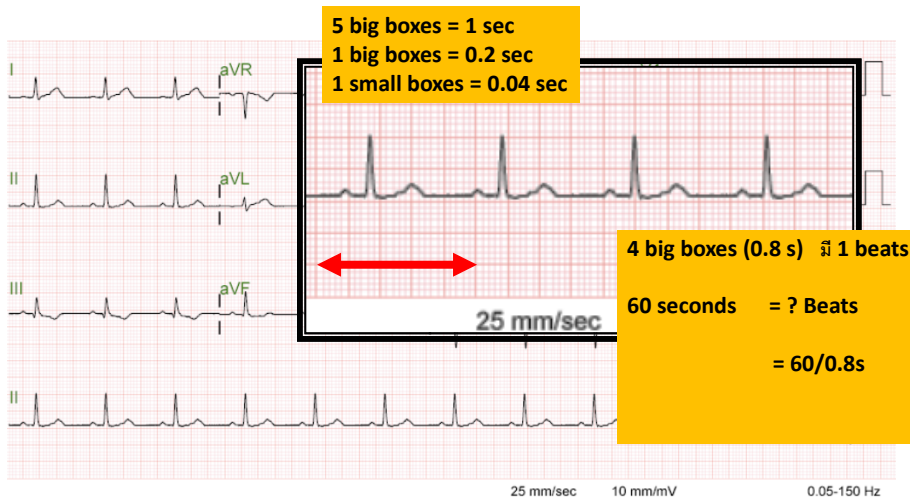
2. Rate
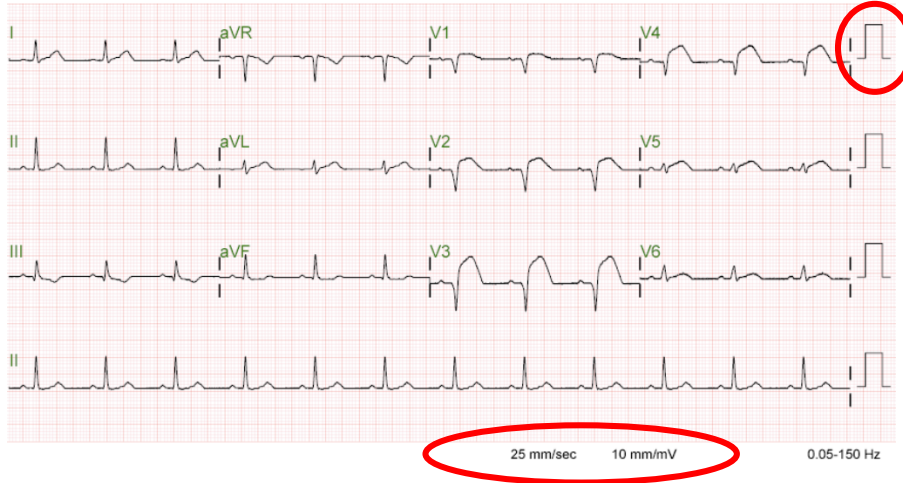### How many beats per minute?

60 วินาที คือ   300 bog box

ถ้า QRS ทุก 5 big box   ใน 1 นาที บีบกี่ครั้ง

→300 / 5 = 60 bpm

ถ้า QRS ทุก 3 big box   ใน 1 นาที บีบกี่ครั้ง

→300 / 3 = 100 bpm

RATE =_____.
ช่องใหญ่

2. Rate
How many beat per minute?

RATE =_____
ช่องใหญ่

$\dfrac{300}{3.3}$ = 91 bpm

300   150   100   75   60

2. Rate
in an irregular rhythm?
HR = QRS x 6
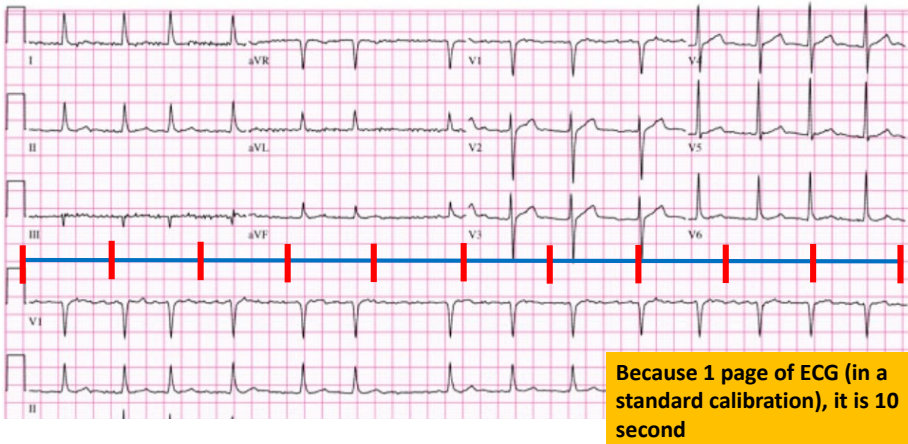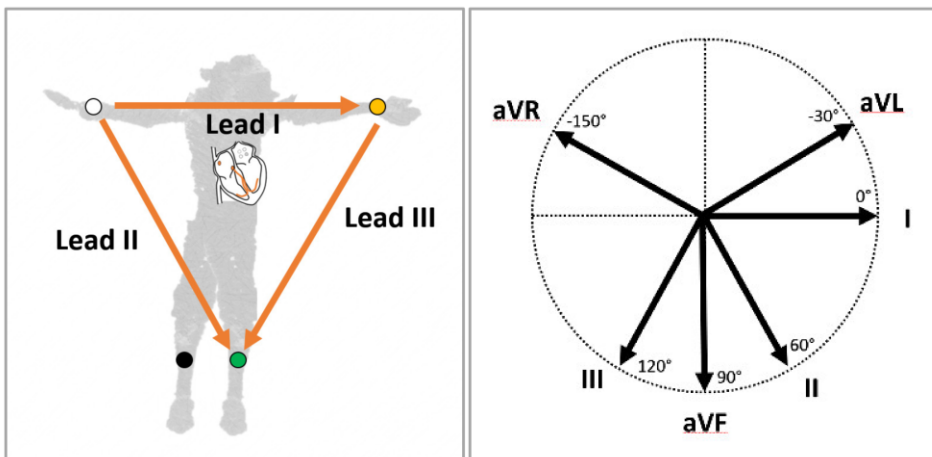
Because 1 page of ECG (in a standard calibration), it is 10 second

3. Axis
- What is a vector of the ventricle in a frontal plane?

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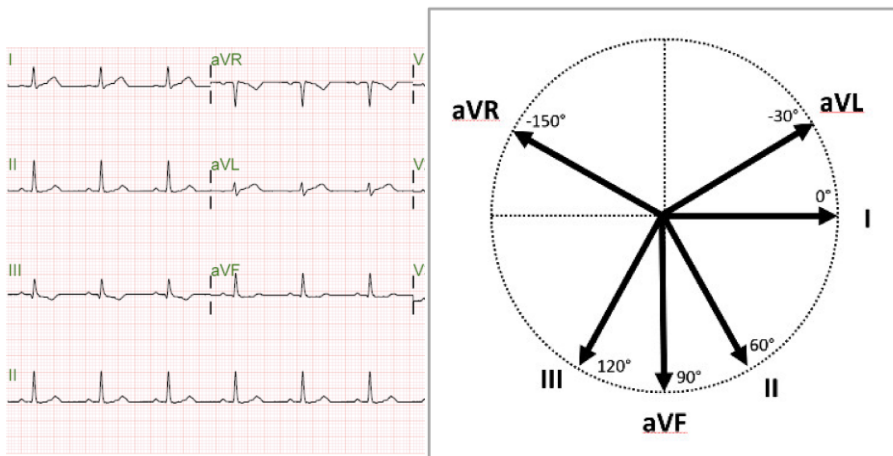
3. Axis
- What is a vector of the ventricle in a frontal plane?
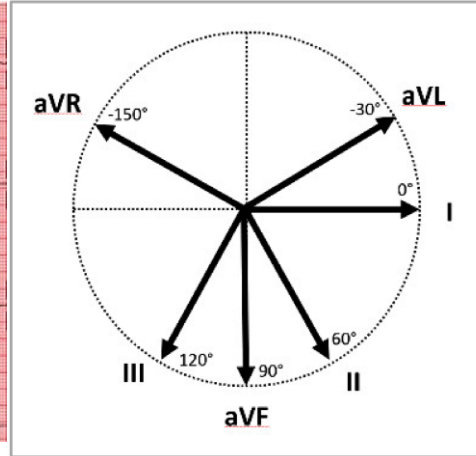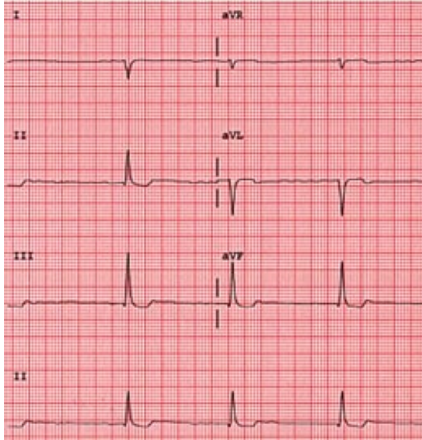
3. Axis
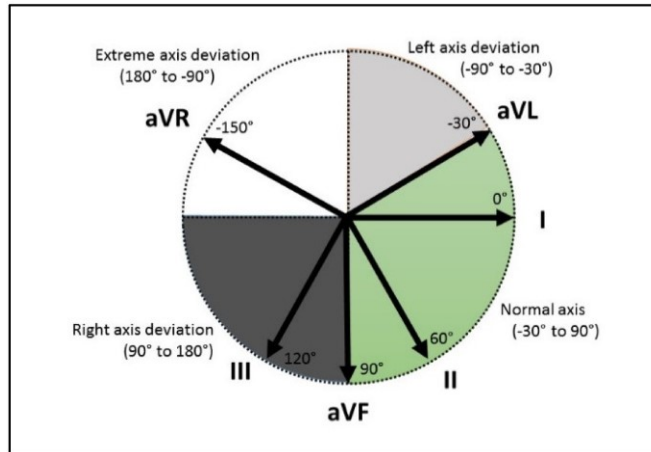- What is a vector of the ventricle in a frontal plane?

SHORT CUT
- Positive QRS in lead I
- Positive QRS in lead II
= NORMAL AXIS

Lead I	Lead II	Axis
Positive	Positive	Normal axis
Positive	Negative	Left axis deviation
Negative	Positive	Right axis deviation
Negative	Negative	Usually extreme axis deviation*
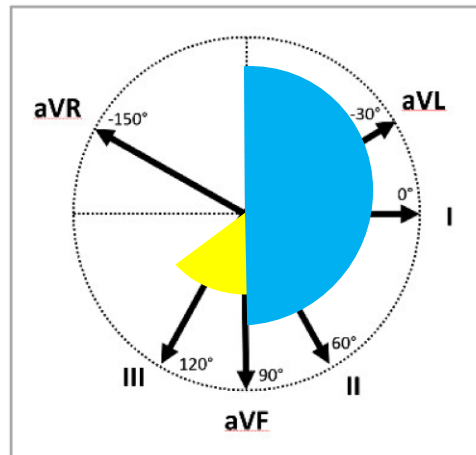
4. rhythm: Sinus rhythm?

= from SA node
= Regular, normal looking P wave (positive in I, aVF) usually follow by narrow QRS

25 mm/sec   10 mm/mV   0.05-150 Hz
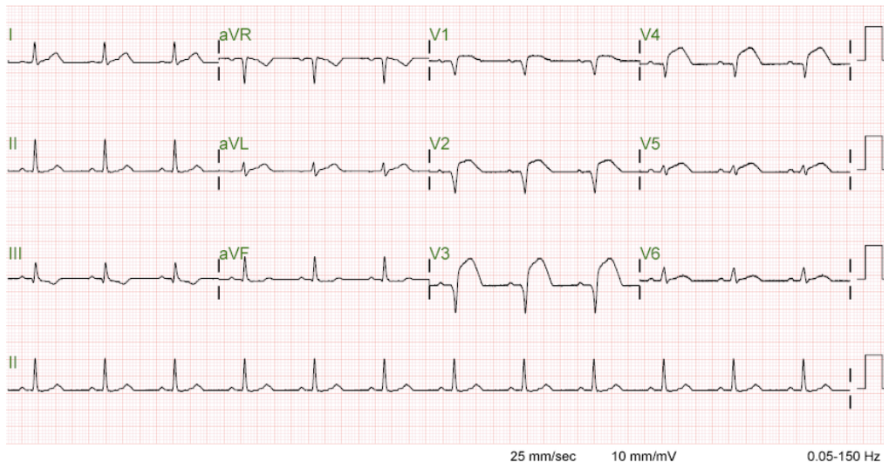
4. rhythm: Not a sinus rhythm?

= ARRHYTHMIA
= Regular, normal looking P wave (positive in I, aVF) usually follow by narrow QRS
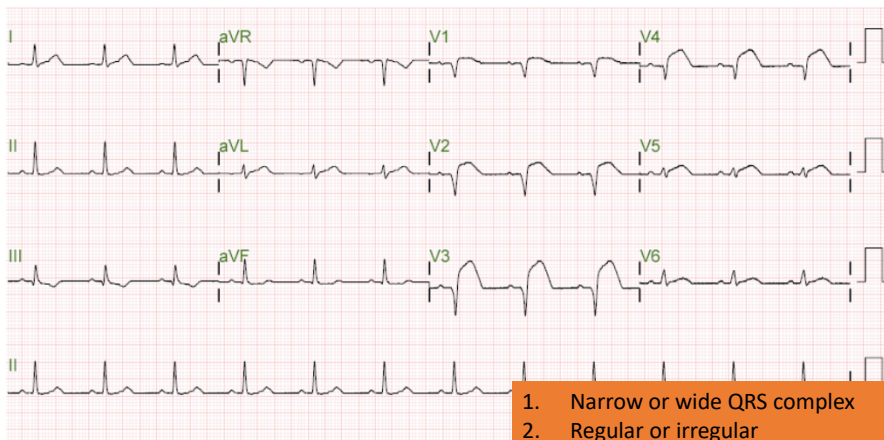
1. Narrow or wide QRS complex
2. Regular or irregular
3. Brady or tachycardia
ติดไว้ก่อน

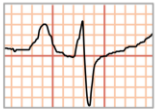| Regularity	QRS complex	Rate	Selected examples

Regular	Narrow	Tachycardia	- Sinus tachycardia
			- Supraventricular tachycardia (SVT)
			  - Atrioventricular nodal reentrant tachycardia (AVNRT)
			  - Atrioventricular reentrant tachycardia (AVRT); orthodromic type
			  - Atrial tachycardia (AT)
			- Atrial flutter

Regular	Wide	Tachycardia	- Ventricular tachycardia - SVT with bundle branch block, aberrancy or pre-excitation - AVRT; antidromic type - Pace rhythm
Regular	Narrow	Bradycardia	- Sinus bradycardia - Junctional rhythm
Regular	Wide	Bradycardia	- Ventricular rhythm
Irregular	Narrow	Tachycardia	- Atrial fibrillation - Multifocal atrial tachycardia (MAT) - Atrial flutter (with variable conduction)
Irregular	Wide	Tachycardia	- Ventricular fibrillation
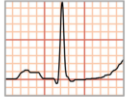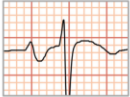
5. P wave = Arial depolarization

Normal P wave	Positive in I, aVF < 3 small boxes < 2.5 mm		
		V1	aVF

5. P wave = Arial depolarization

Normal   **< 3x3 small boxes, positive in II, AVF**
Abnormal   **ATRAIL ENLARGEMENT**

RAE	Peak P	
		Limb leads
LAE	Broad, notched P, biphasic P (V1)	
		Limb leads V1
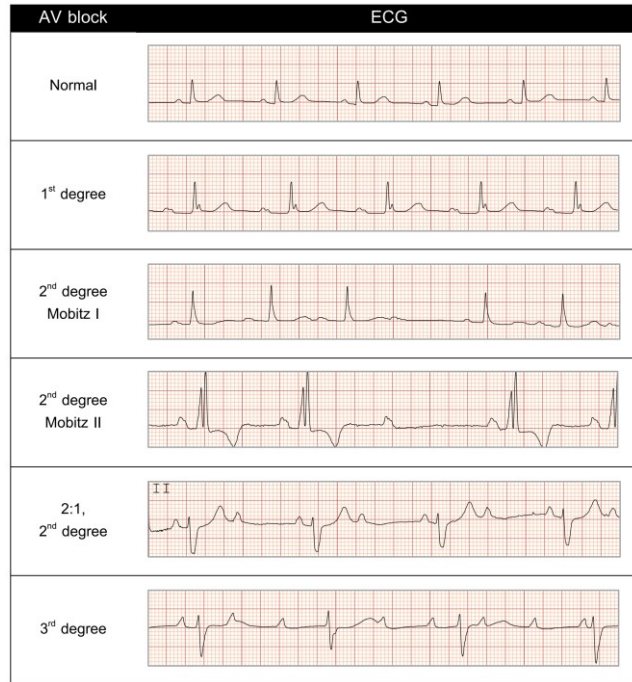
AV block — ECG

Normal	
1st degree	
2nd degree Mobitz I	
2nd degree Mobitz II	
2:1, 2nd degree	
3rd degree	

6. PR interval = AV nodal conduction delay
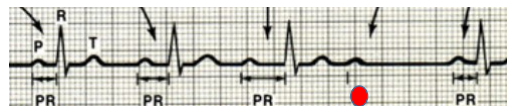From beginning of P to beginning of QRS
Normal < 5 small boxes

- First degree AV block
  (All P conduct QRS but not Prolong PR)
  Constant, prolong PR > 5 small boxes

- Second degree AV block
  (some P dose not conduct QRS)

  - Mobitz I (Wenckebach)
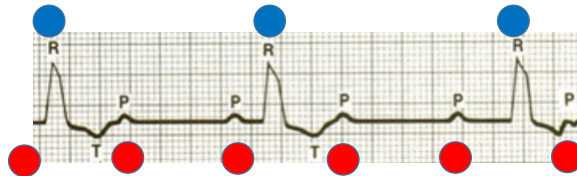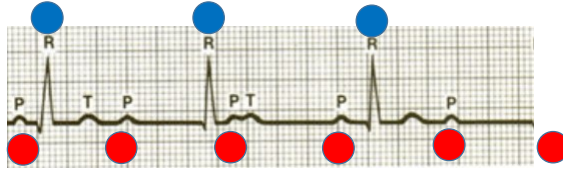 (prolonging PR then drop)
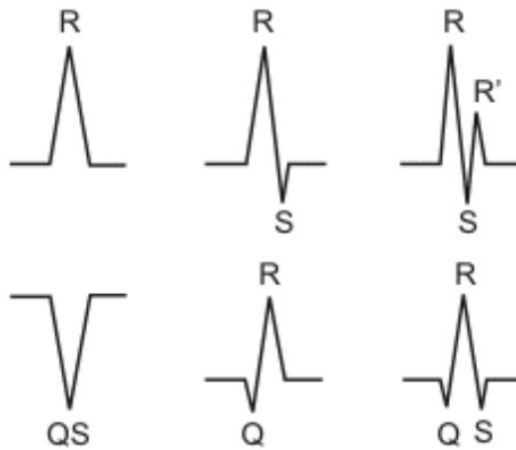

  - Mobitz II
  (constant PR then drop)

6. PR interval = AV nodal conduction delay
From beginning of P to beginning of QRS
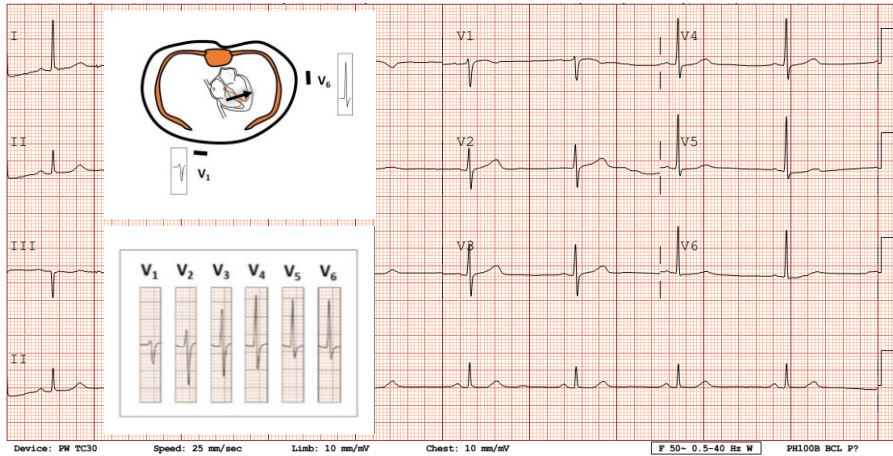Normal < 5 small boxes

- Third degree AV block
  (no conduction at all)

7. QRS complex: Ventricular depolarization

7. QRS complex: Normal transition

7. QRS complex: Ventricular depolarization
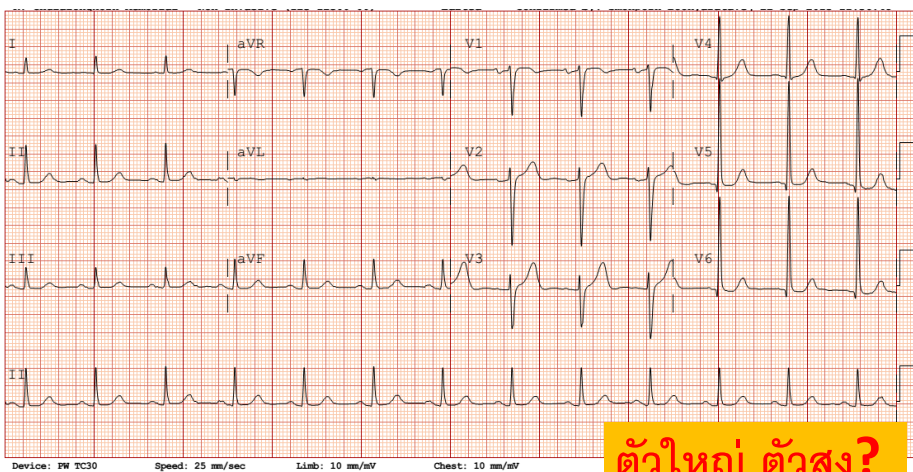
ตัวใหญ่ ตัวสูง?

7. QRS complex: ↑ amplitude = hypertrophy
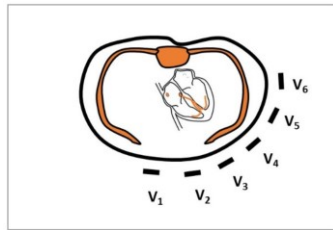
LVH (Sokolow-Lyon criteria)	$S_{V1} + R_{V5\ or\ V6}$ ≥ 35	V1	V6
LVH (Cornell criteria)	$R_{aVL} + S_{V3}$ > 20 in women > 28 in men	aVL	V3
RVH	R_{V1} > 7 mm R/S ratio $_{V1}$ > 1	V1	

7. QRS complex: Ventricular depolarization
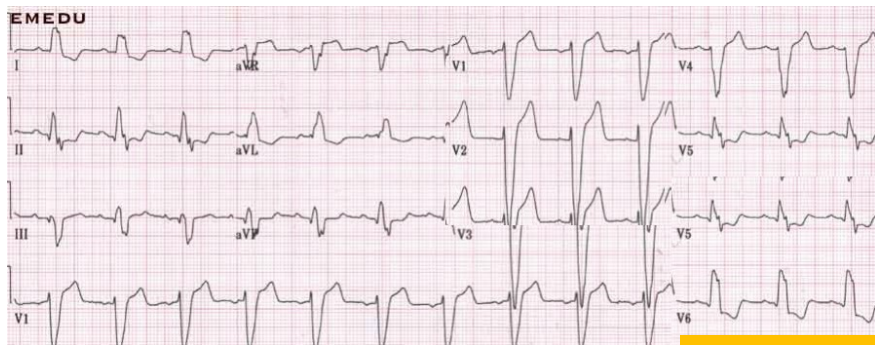
ตัวกว้าง?

7. QRS complex: ↑ duration = bundle branch block
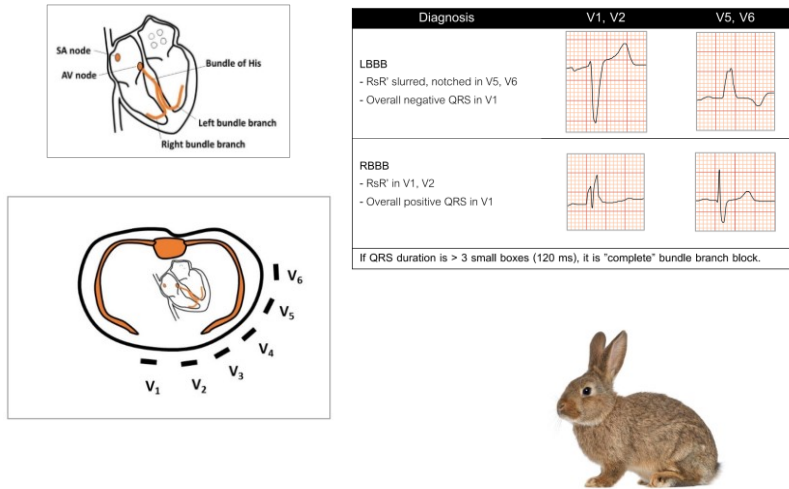## if QRS > 3 small boxes = complete

Diagnosis	V1, V2	V5, V6
LBBB - RsR' slurred, notched in V5, V6 - Overall negative QRS in V1		
RBBB - RsR' in V1, V2 - Overall positive QRS in V1		

If QRS duration is > 3 small boxes (120 ms), it is "complete" bundle branch block.

Ventricular repolarization

8.1 ST segment

Normal: not elevate, or depress

ST depression, ST elevation

Abnormal in ischemia // electrolyte // drug //

Abnormal depolarize (BBB, hypertrophy)

Other abn reporalization

8.2. T wave

Normal: Upright

Inverted T
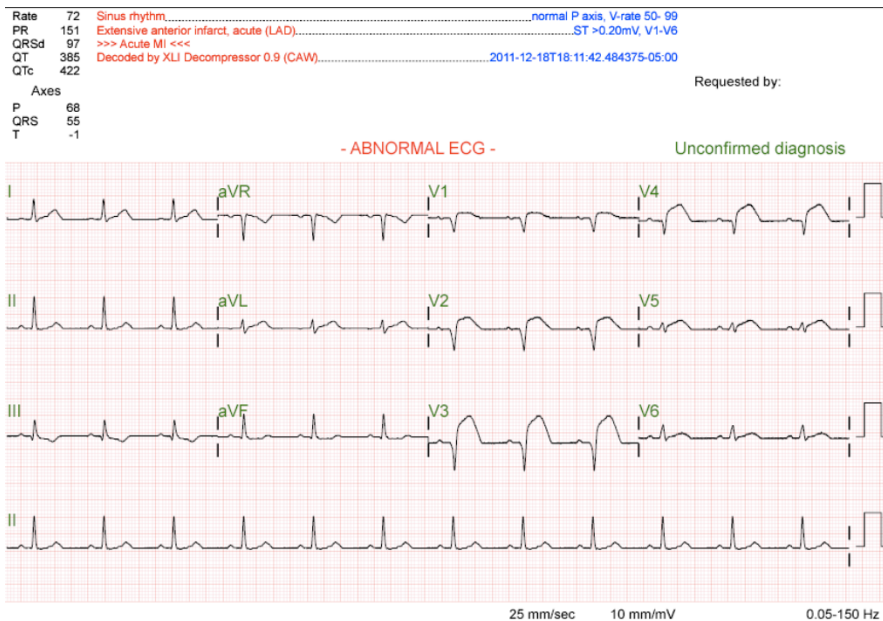
Abnormal in ischemia, electrolyte, abnormal reporalization

10. QT interval

normal < ½ RR, QTC = QT (in ms) / √RR(in sec)

Prolong QT

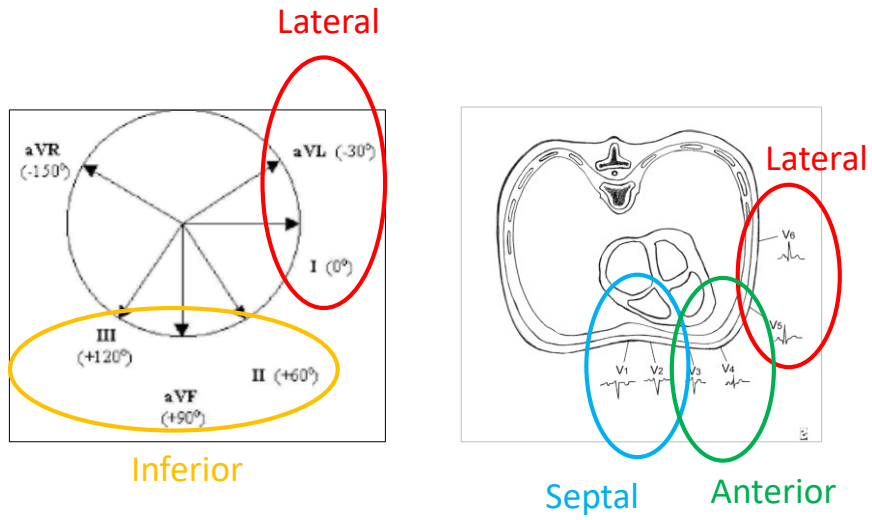Normal : Men < 440 ms , female < 460 ms

ST-T changes secondary to NSTEMI	Horizontal, down-sloping ST depression	V5
Acute STEMI	ST elevation convex, tombstone	V5
Old/remote MI	Pathologic Q (1 small box and 1 mm in 2 leads)	

Rate 72 Sinus rhythm...normal P axis, V-rate 50- 99
PR 151 Extensive anterior infarct, acute (LAD)...ST >0.20mV, V1-V6
QRSd 97 >>> Acute MI <<<
QT 385 Decoded by XLI Decompressor 0.9 (CAW)...2011-12-18T18:11:42.484375-05:00
QTc 422

Requested by:

Axes
P 68
QRS 55
T -1

- ABNORMAL ECG -   Unconfirmed diagnosis

I   aVR   V1   V4

II   aVL   V2   V5

III   aVF   V3   V6

II

25 mm/sec   10 mm/mV   0.05-150 Hz

Lead locations (wall)

Lateral

aVR (-150°) aVL (-30°) I (0°) III (+120°) aVF (+90°) II (+60°)

Inferior

Lateral

Septal Anterior

T wave inversion	Point downward except in aVR and V1.	

Normal QT interval	M < 440 ms F < 460 ms less than half RR	

10. ECG diagnosis (need pattern recognition)

- PAC   premature atrial contraction
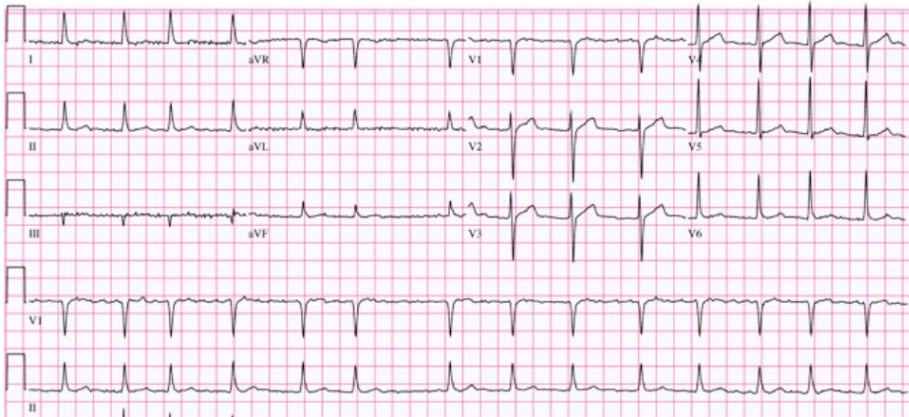- PVC   premature ventricular contraction
- Hyper K
- Digoxin
- Pericarditis
- WPW
- COPD
- Pacemaker

ARRHYTHMIA

Home work   Atrial fibrillation // Atrial flutter
                 VT // VF
                 PAC // PVC

▶ http://e-learning.md.chula.ac.th
รายวิชา 3000618 Individual Study in Medicine/57-3000618-04
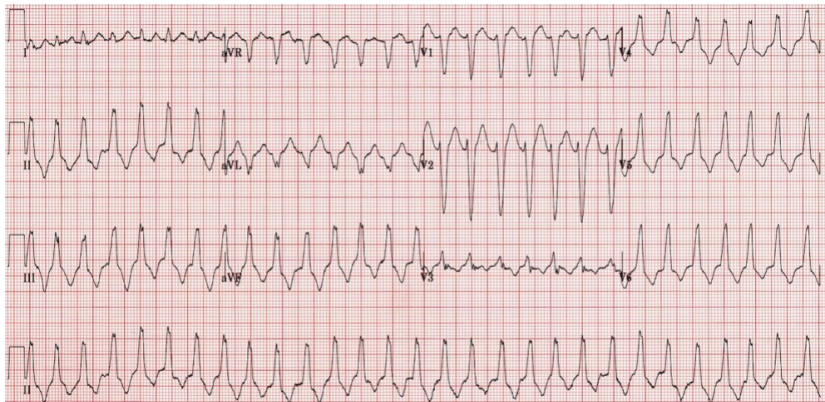EKG for 4th Year Medical Students

Coming soon … ECG mobile application
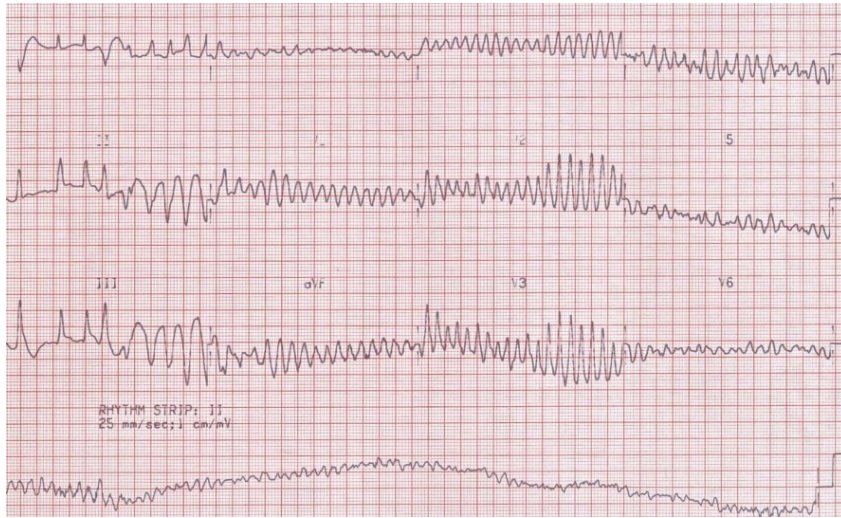
Narrow QRS complex
Irregular
Tachycardia

Atrial fibrillation

There are multiple foci in atria that send out signal at random and very fast pace, some signals conduct ventricles
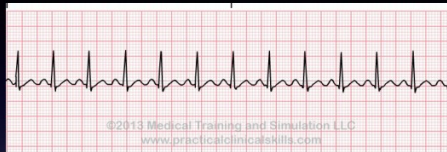

wide, regular, tachy

Ventricular tachycardia
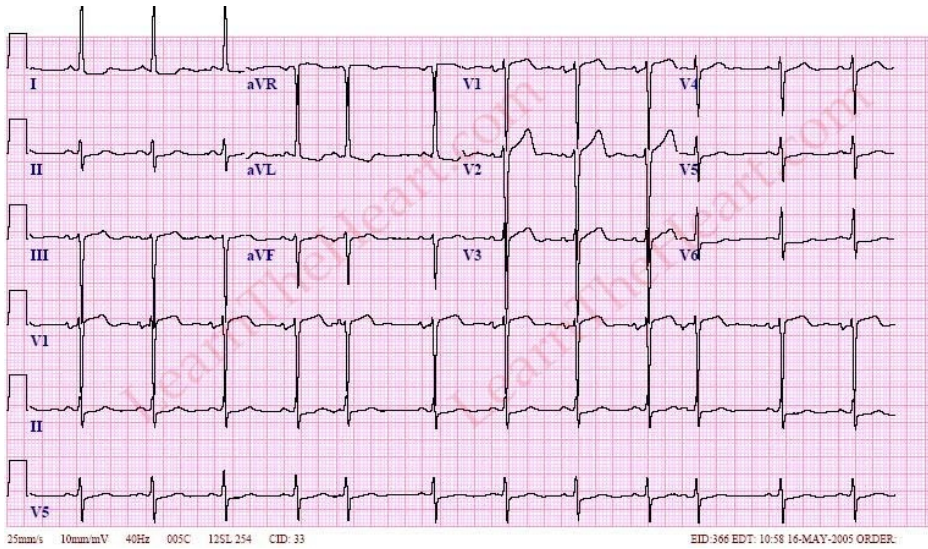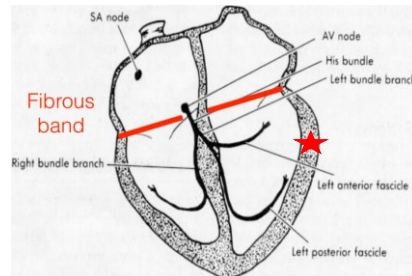
Wide, irregular   Ventricular fibrillation

arrhythmia

Premature Atrial Complex

Premature Ventricular complex