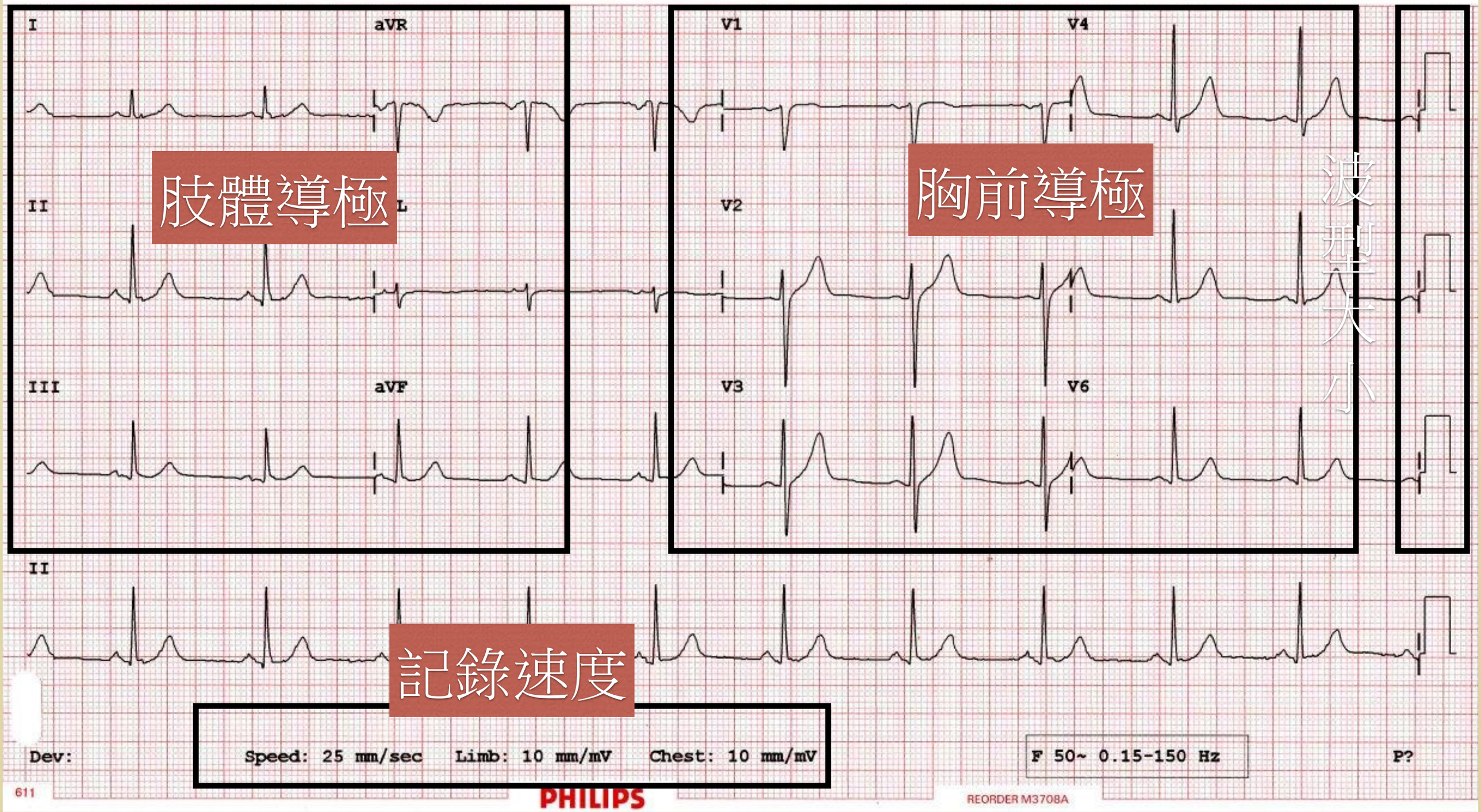
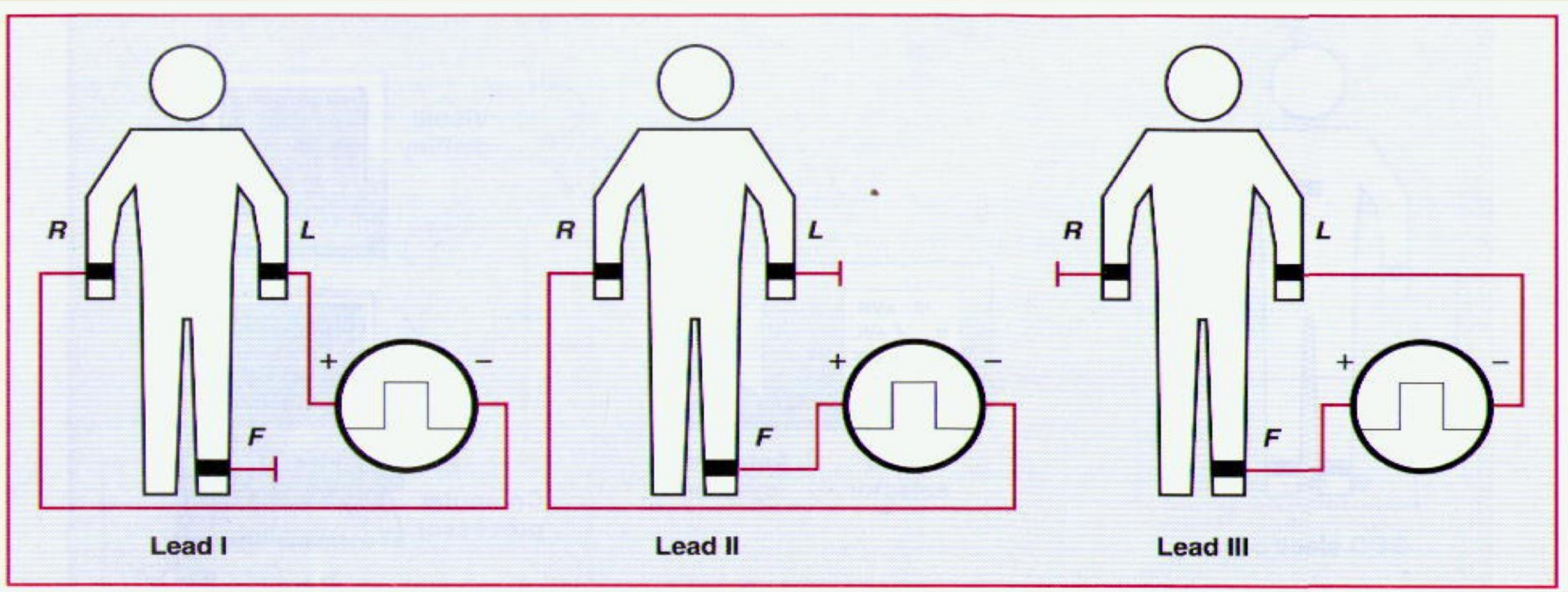
心電圖判讀與診斷

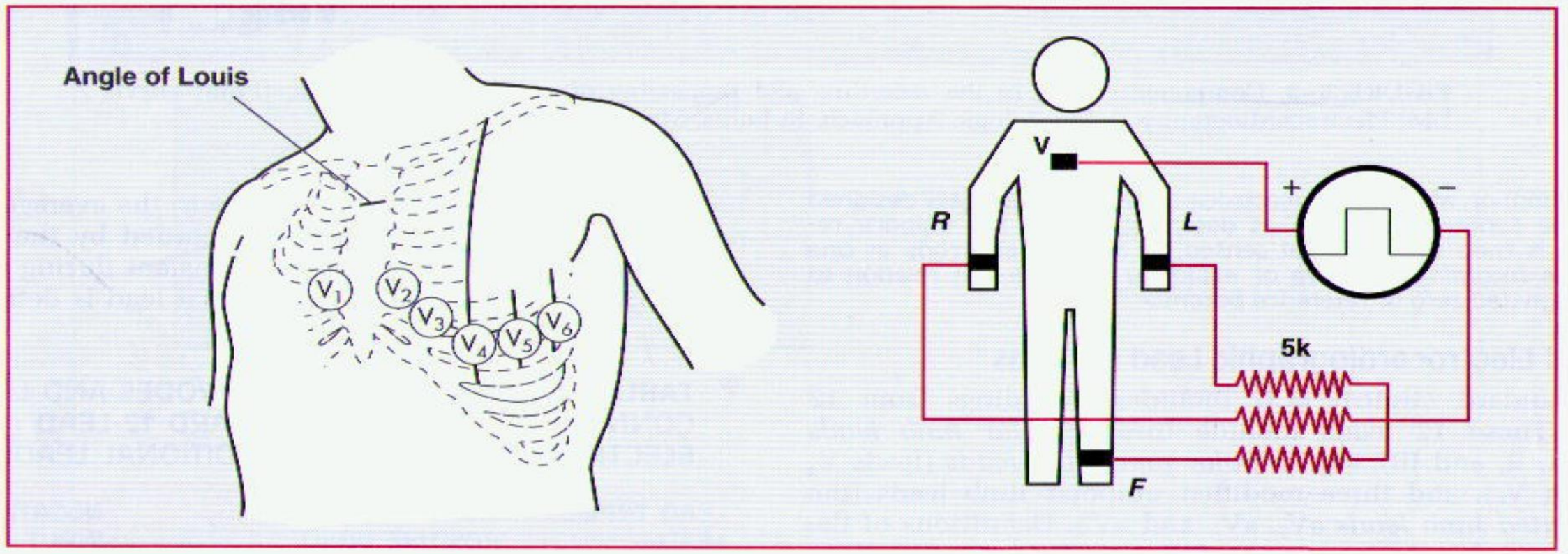
楊宗翰

標準 12 leads ECG 設定

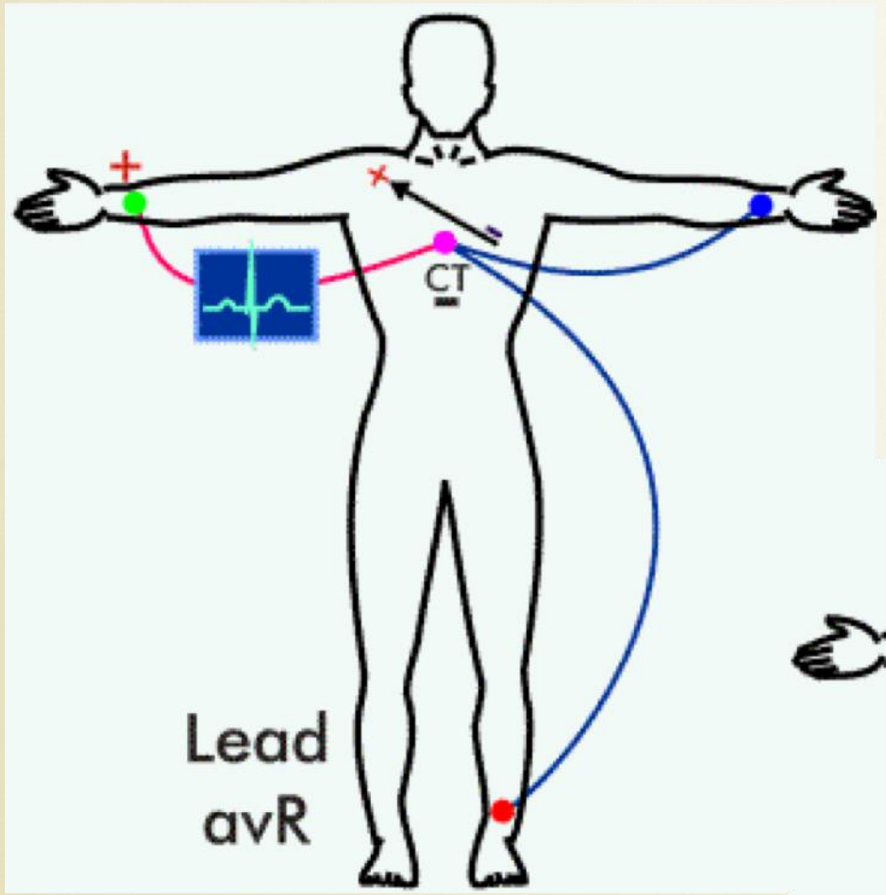


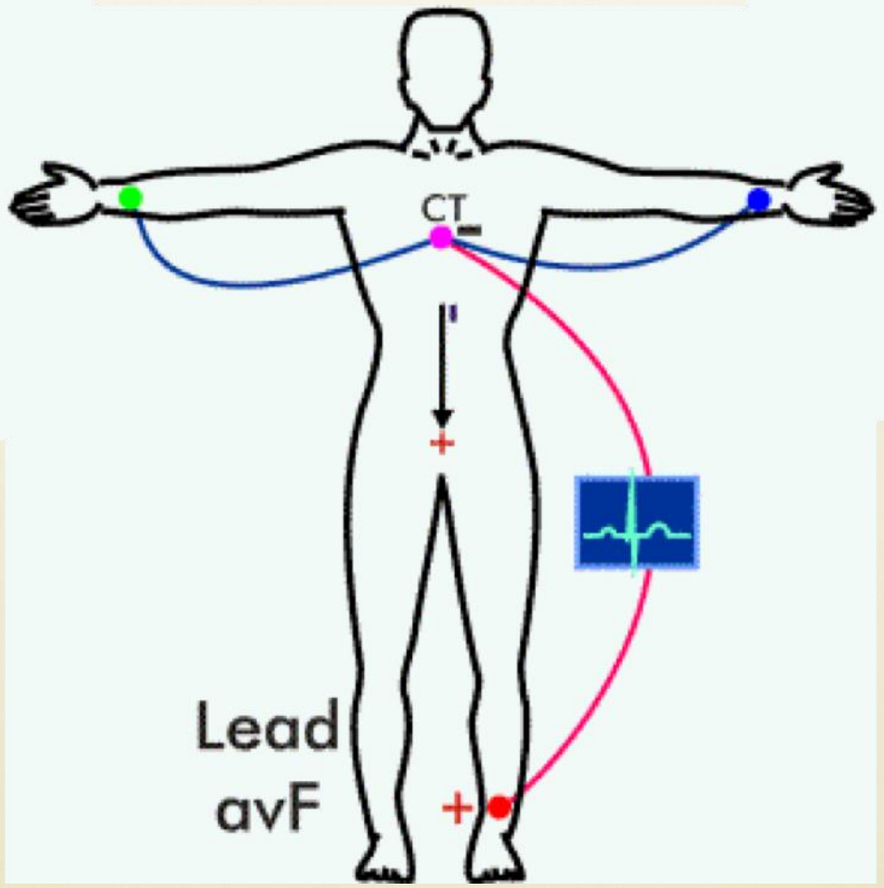
肢體導極如何生成

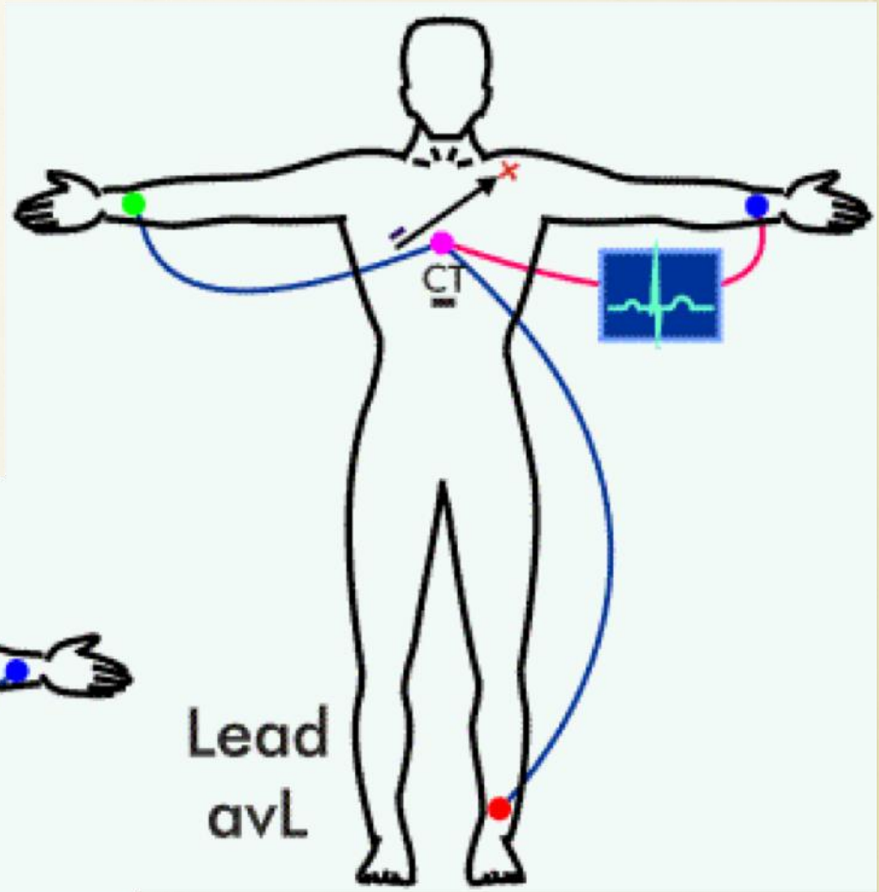

R
L
F
+
−
Lead I
Lead II
Lead III


Angle of Louis
V1
V2
V3
V4
V5
V6
V
R
L
F
+
−
5k

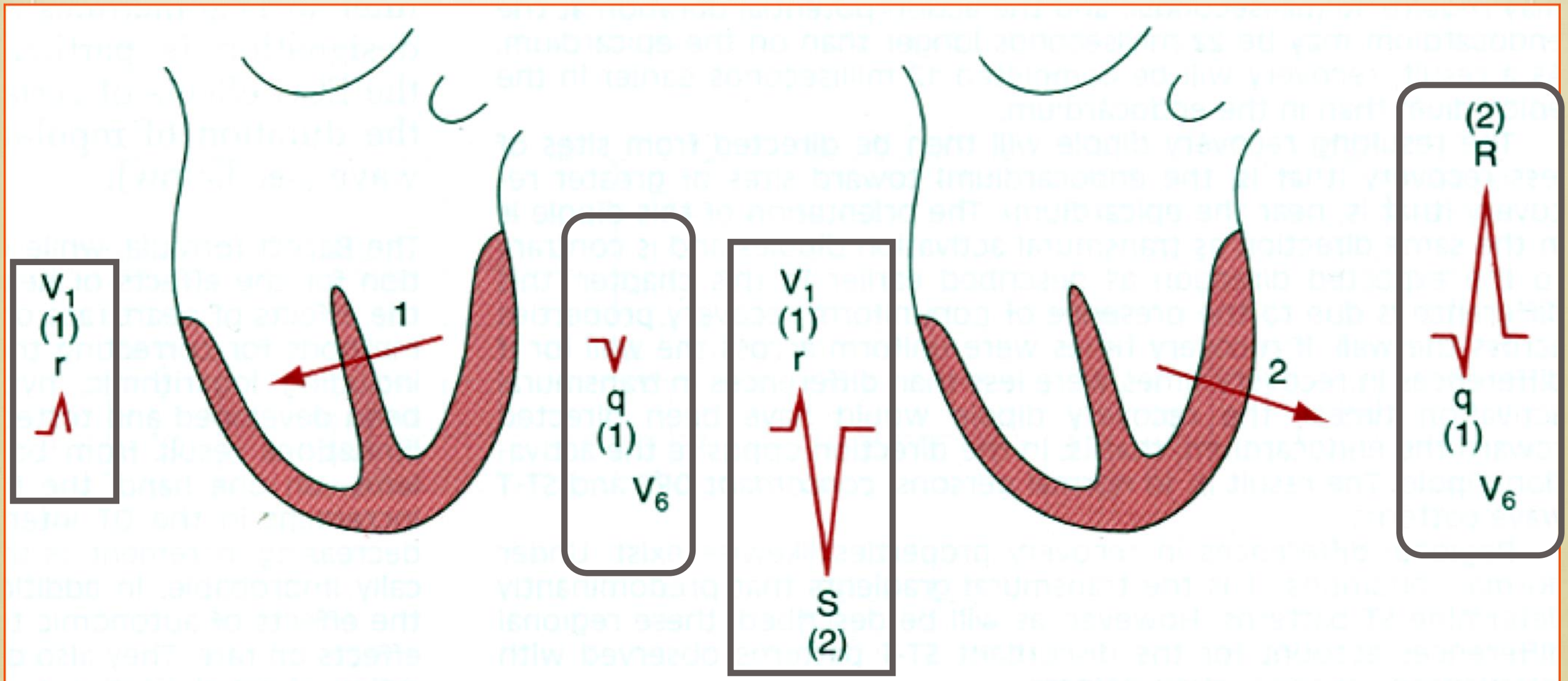
肢體導極如何生成



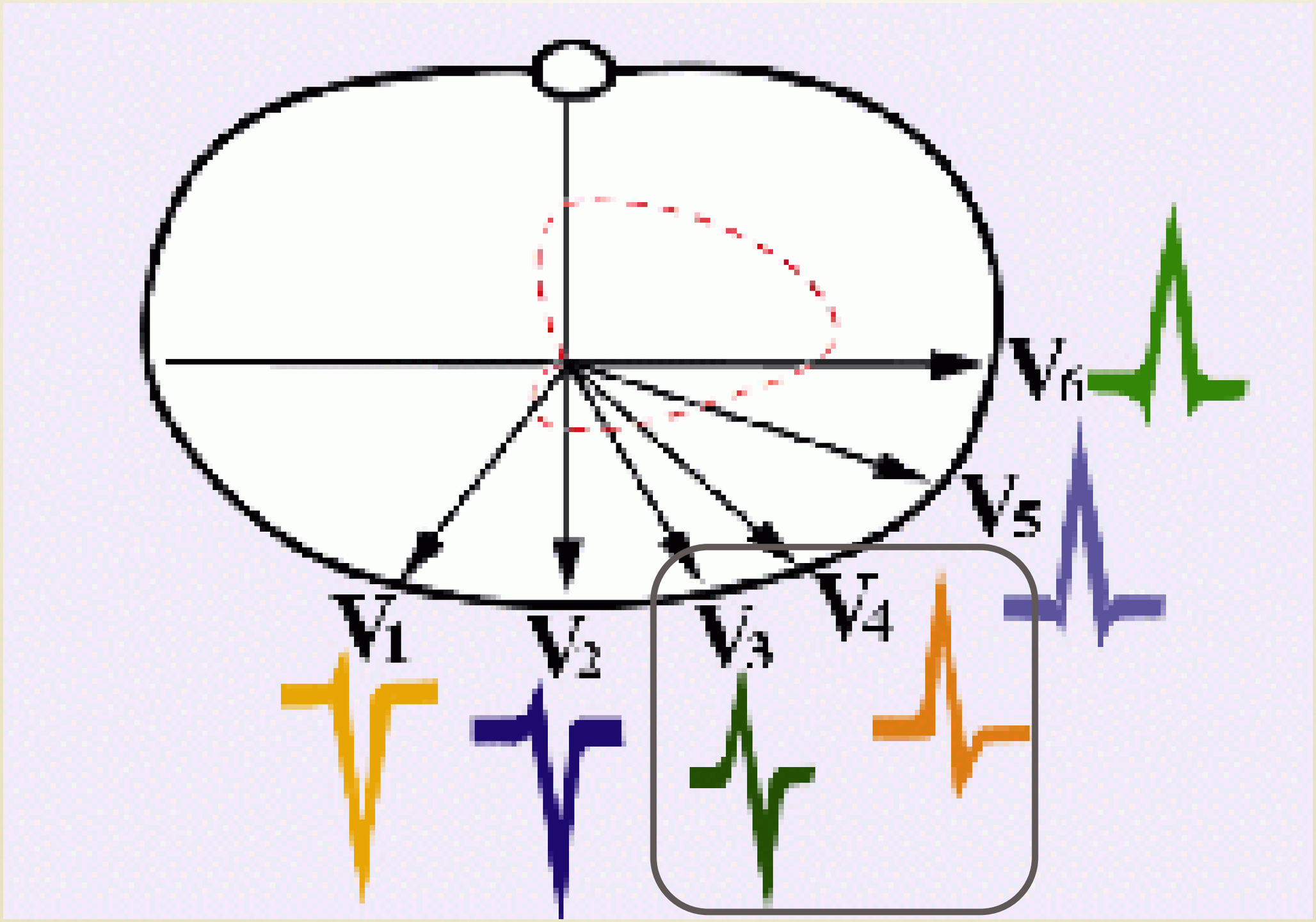




胸前導極如何生成



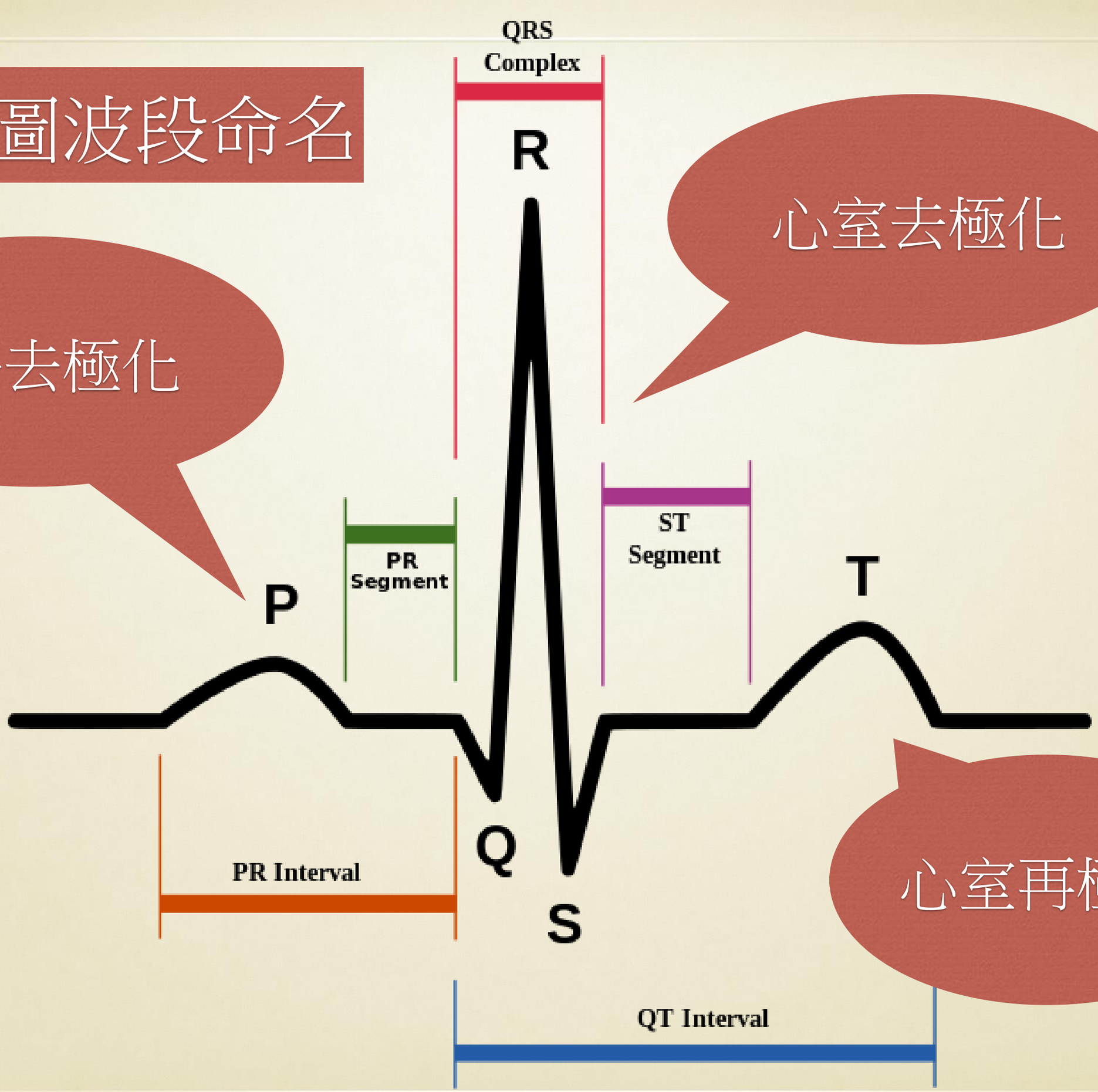
胸前導極



心電圖波段命名

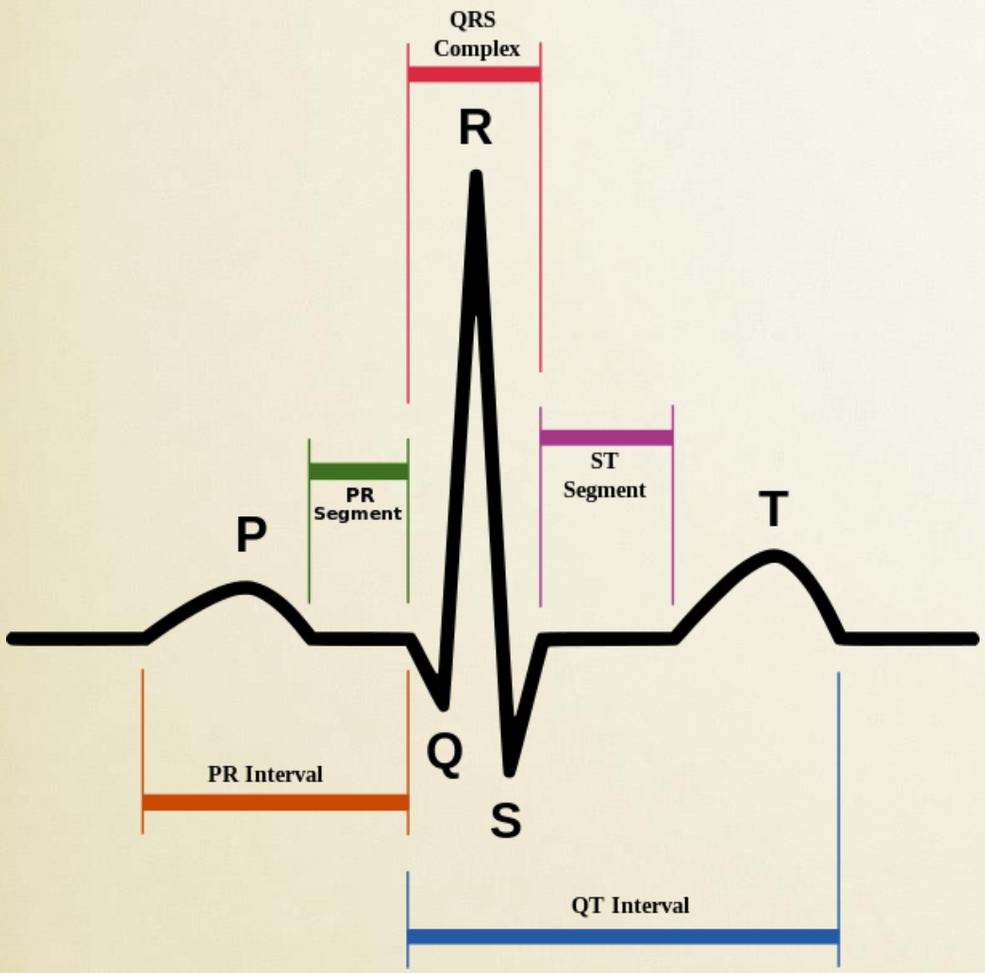
心房去極化

心室去極化



心室再極化

心電圖波段正常值



P: 0.06-0.11 (1-2小格)

PR interval : 0.12-0.2 s (3-5小格)

QRS complex: 0.12 s (3小格)

QT interval : 0.45 s

建議判讀順序

Rate
Rhythm
Axis / Rotation
Chambers
STT changes
Others: QTC, hyperK, hypoCa…

Rapid

Rate

Slow

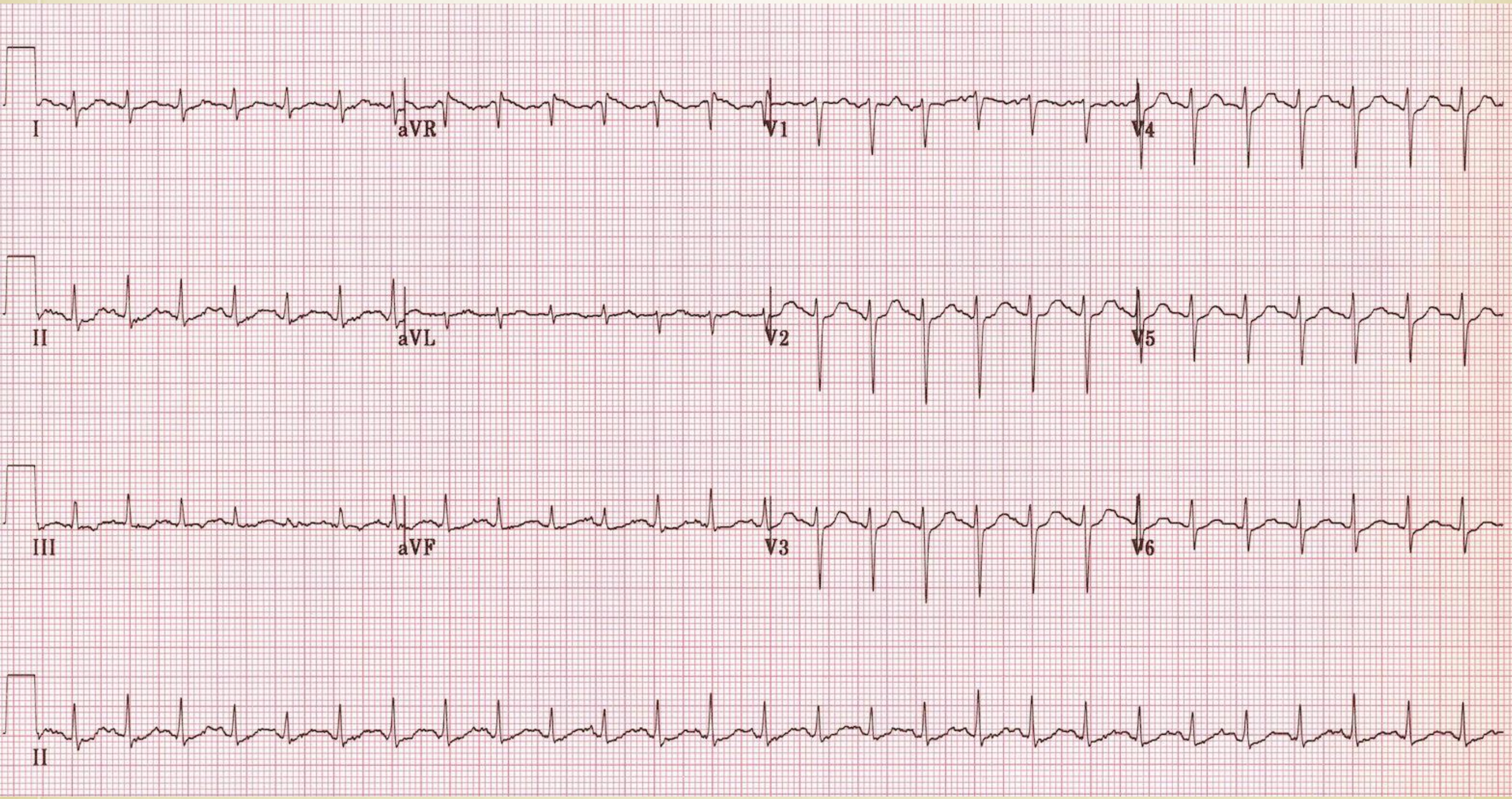
Normal

標準 12 leads ECG
Heart Rate !

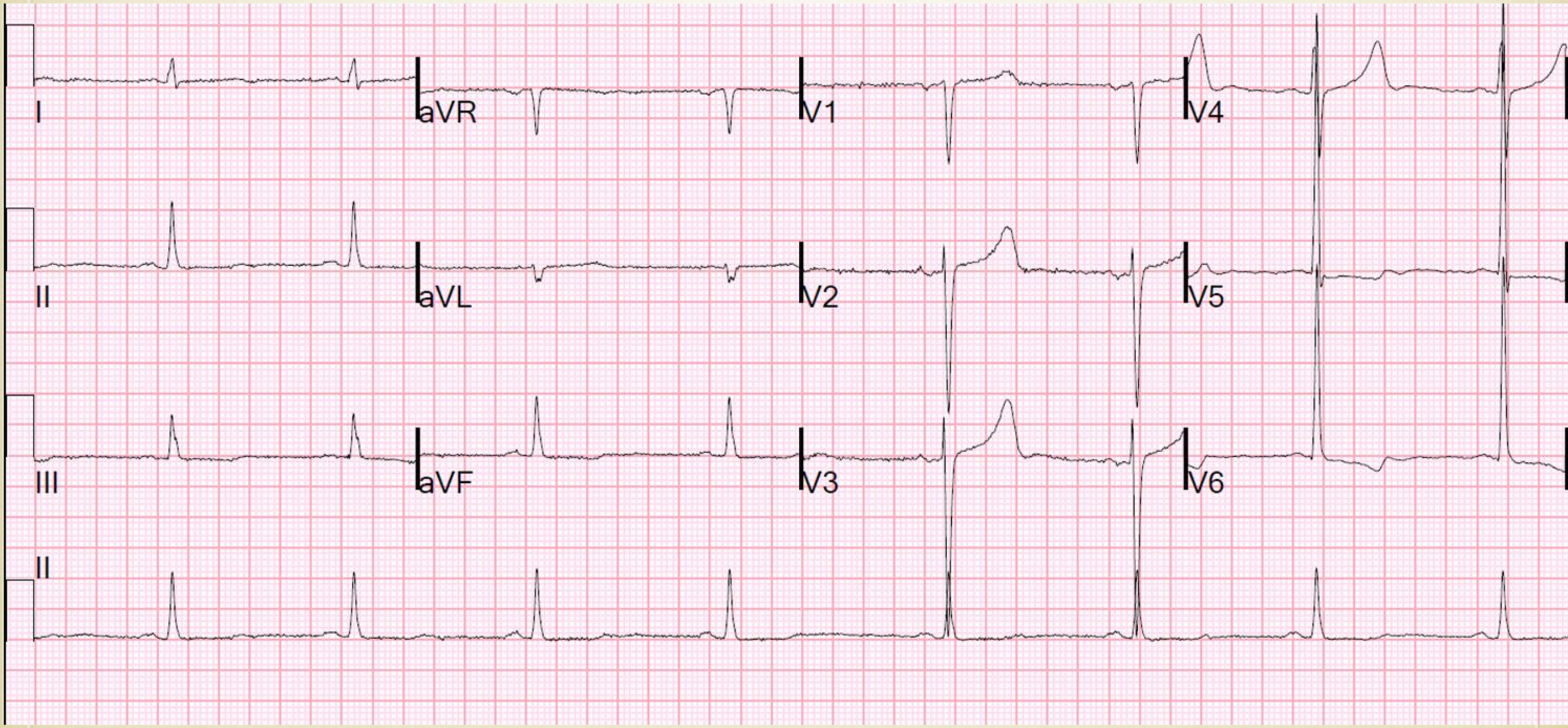
一秒25小格 = 5大格
一張標準心電圖紀錄10秒
每分鐘心跳數 = 心電圖心跳數 x 6

一秒 = 5大格
一分鐘 = 300大格
每分鐘心跳數 = 300 / 每一跳格數
(60 bpm= 300/5, 100 bpm=300/3)

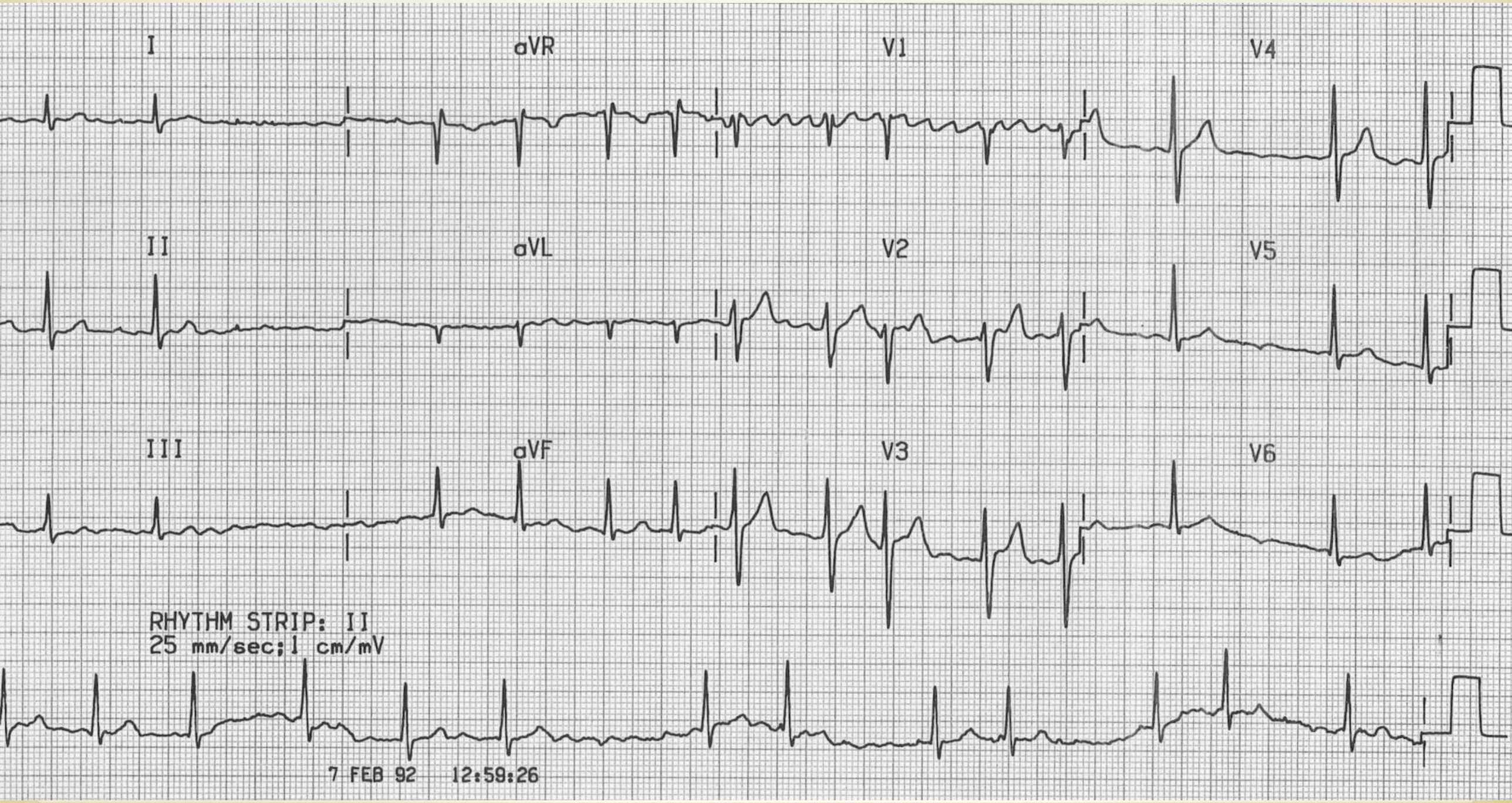
Heart Rate Practice !



Heart Rate Practice !



Heart Rate Practice !



Rhythm

RR interval Regular

P wave ?

Yes : Sinus? flutter?

No : Atrial/Ventricular?

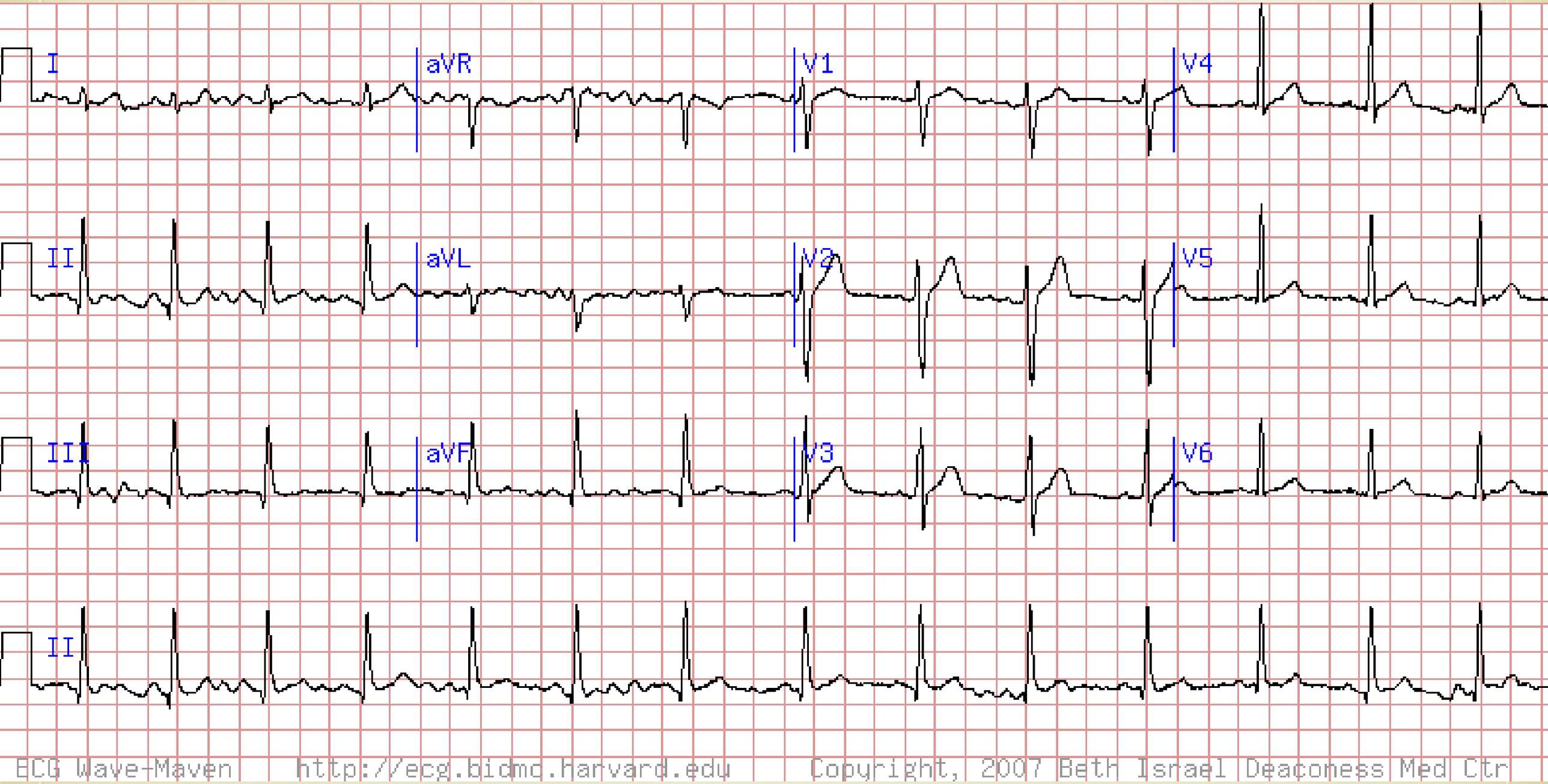
RR interval Irregular

P wave ?

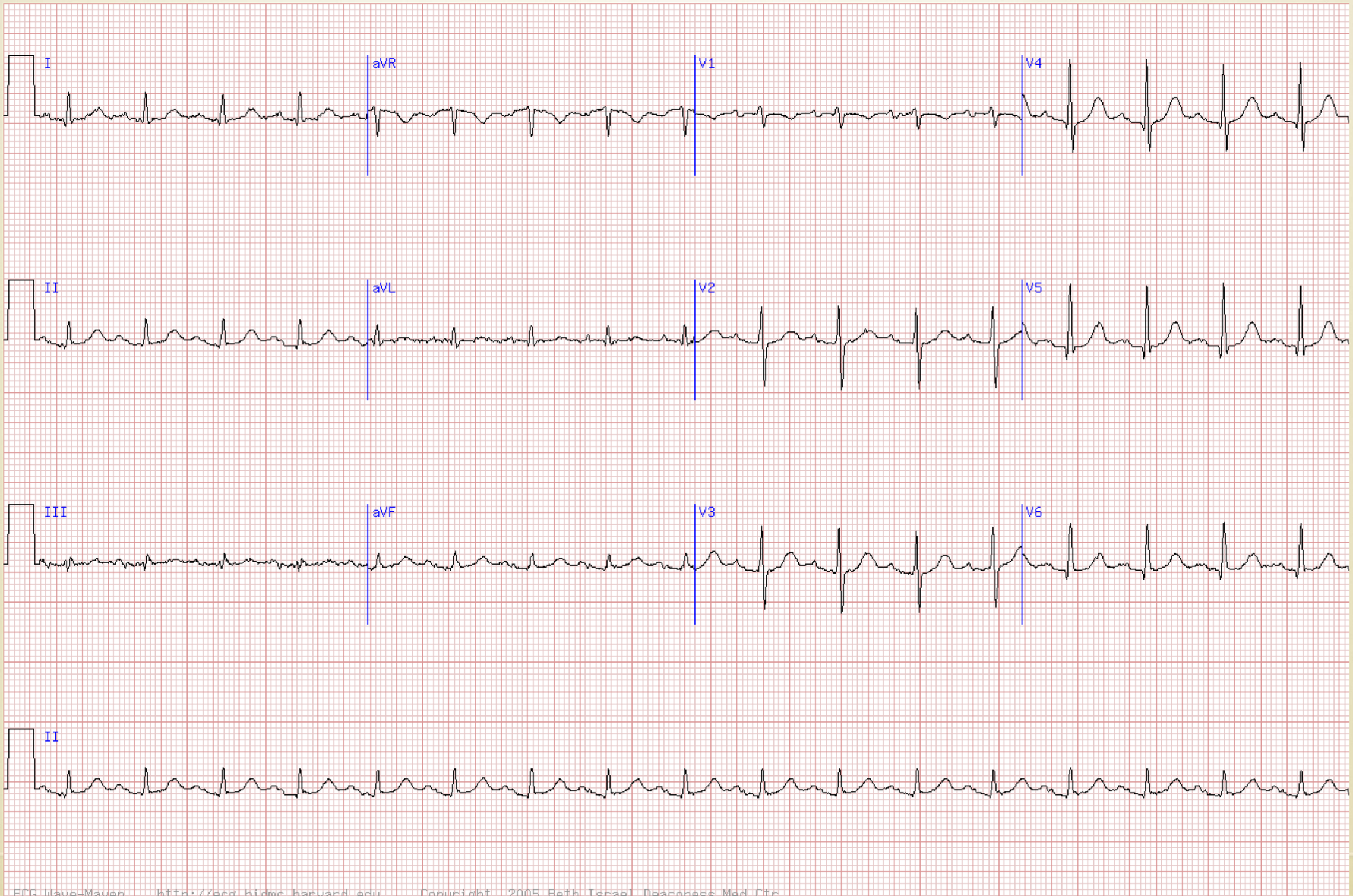
Yes : AVB/APC/VPC ?

No : fibrillation Atrial ?/Ventricular?

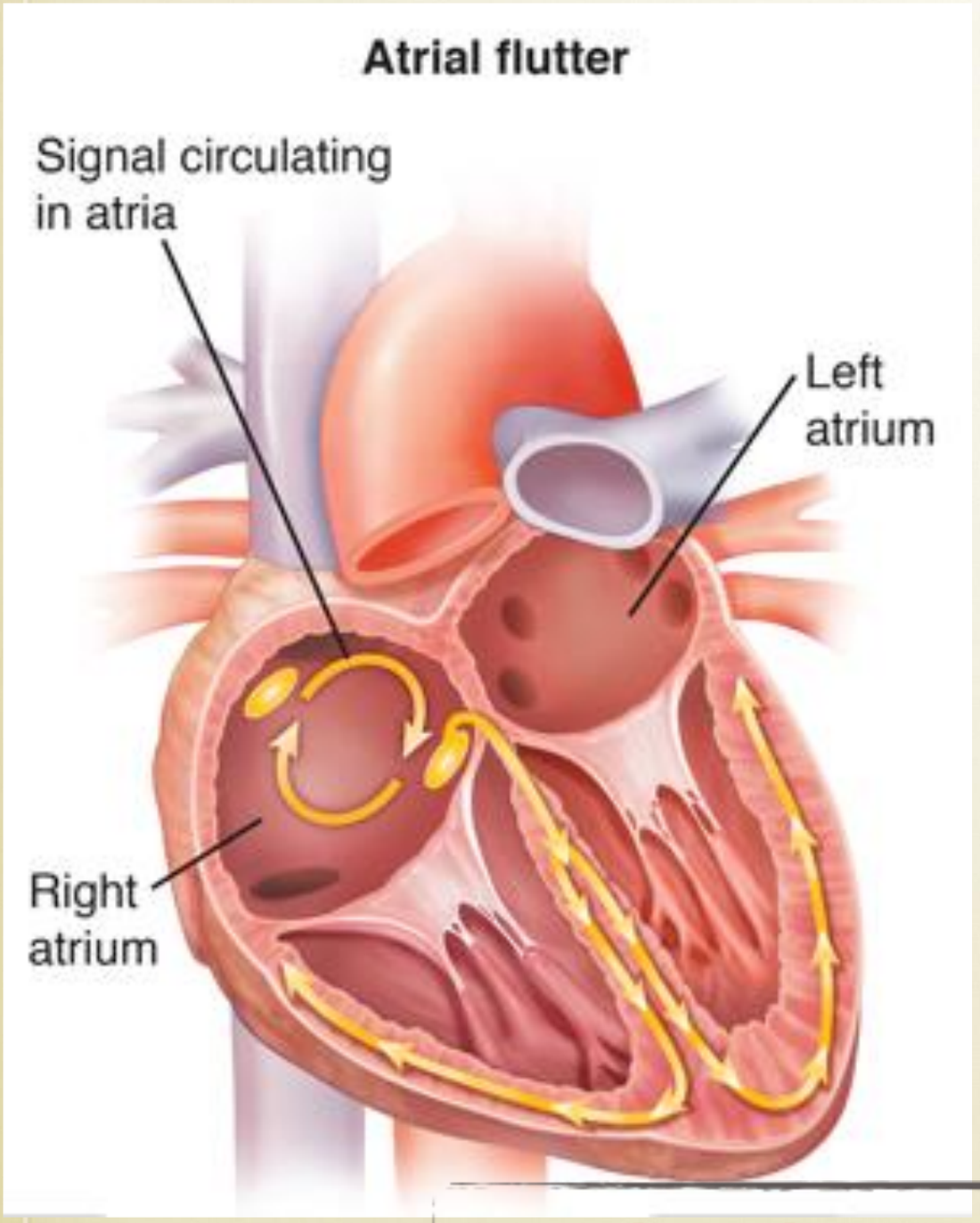
Rhythm Practice !

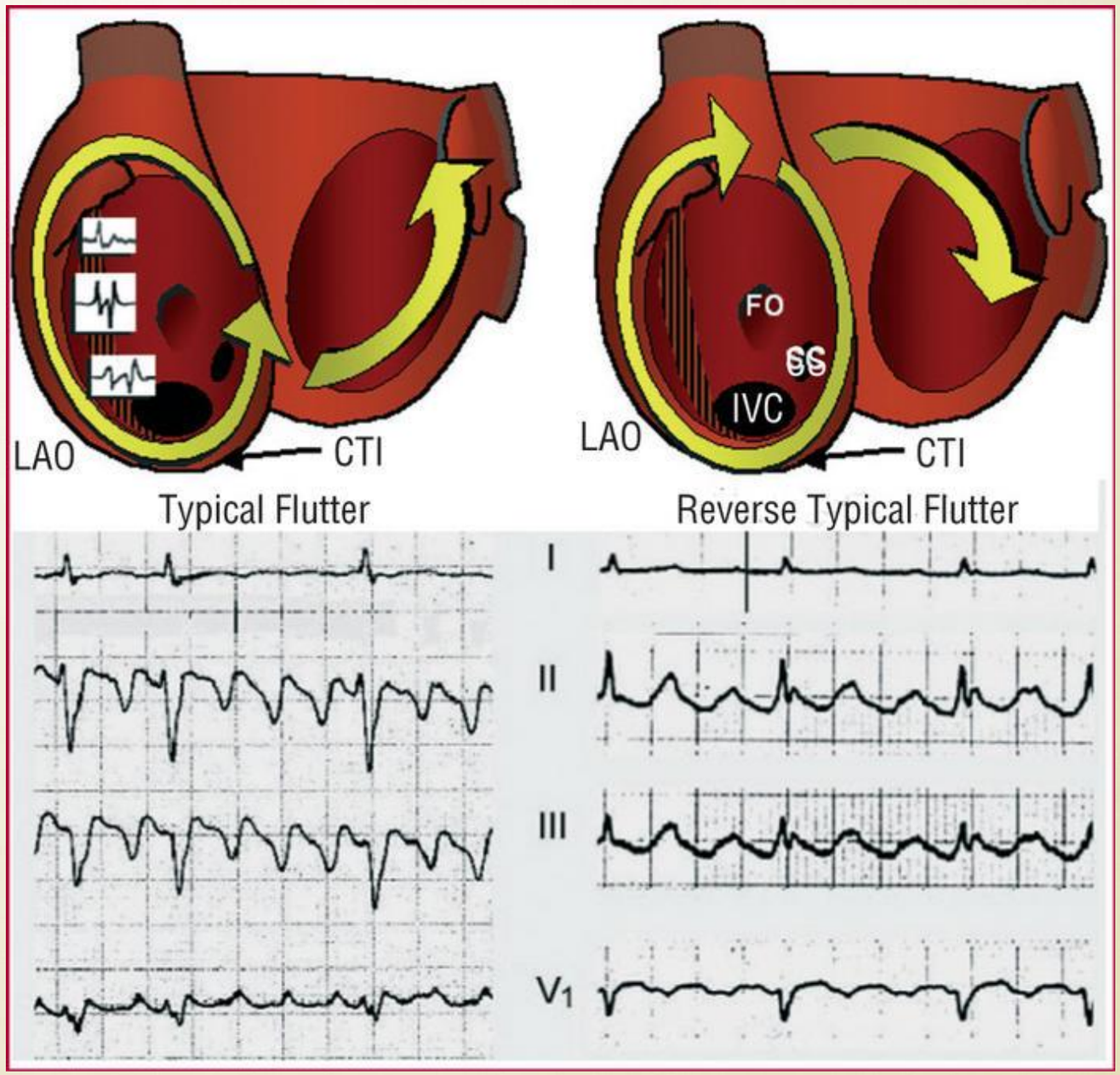


Rhythm Practice !



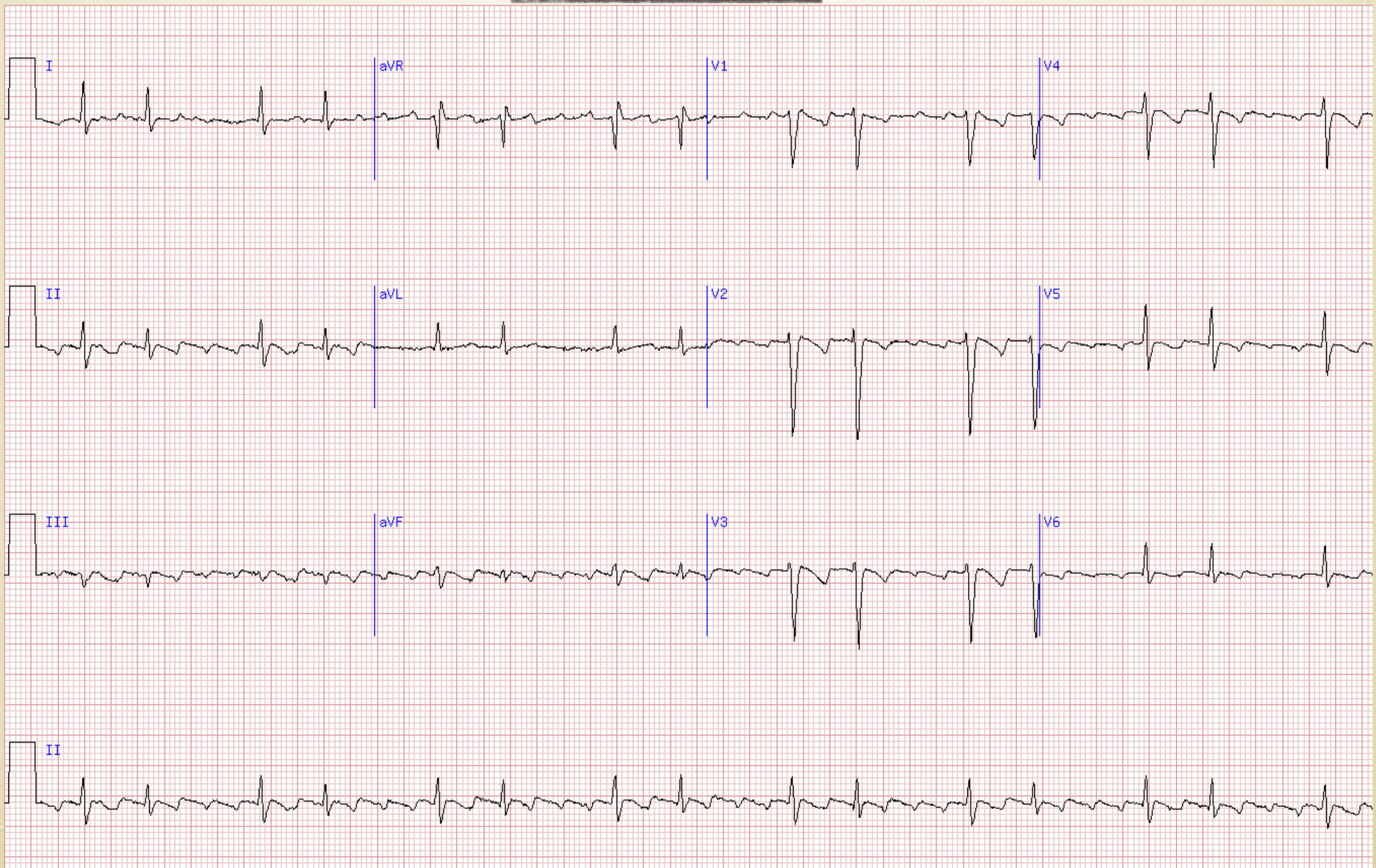
Rhythm
Atrial Flutter !



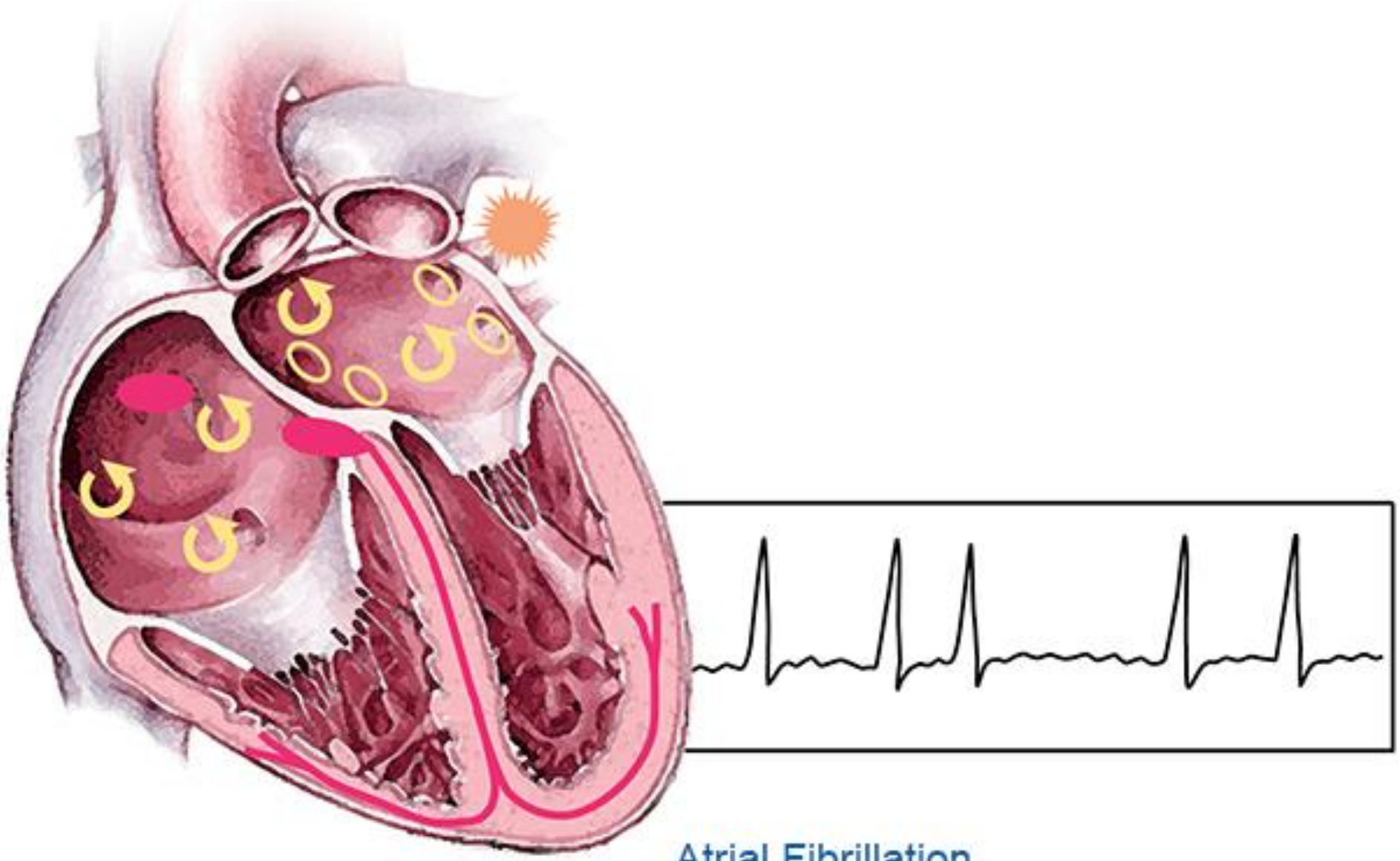


clockwise or counterclockwise!

Rhythm Practice !

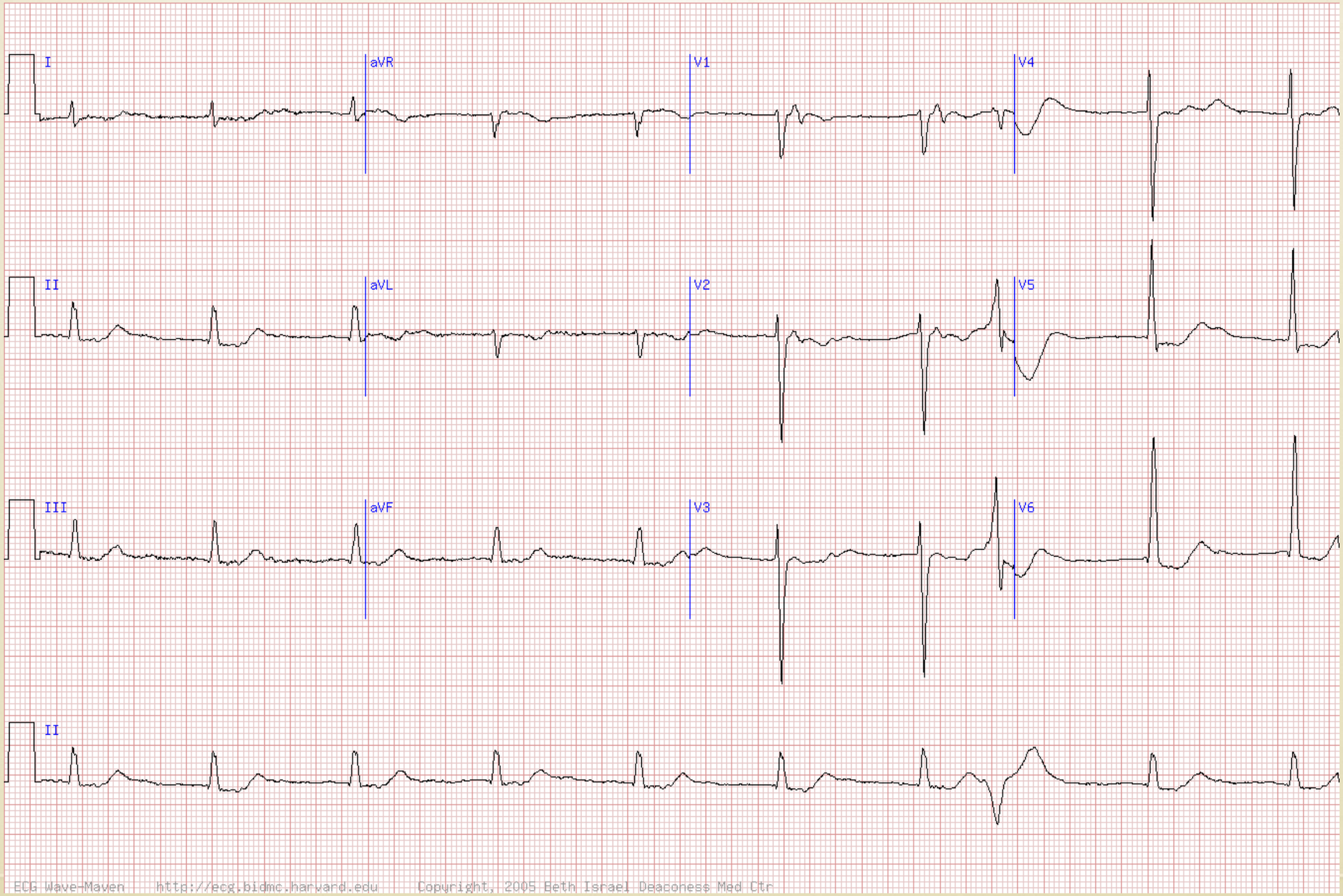


Rhythm
Atrial fibrillation !

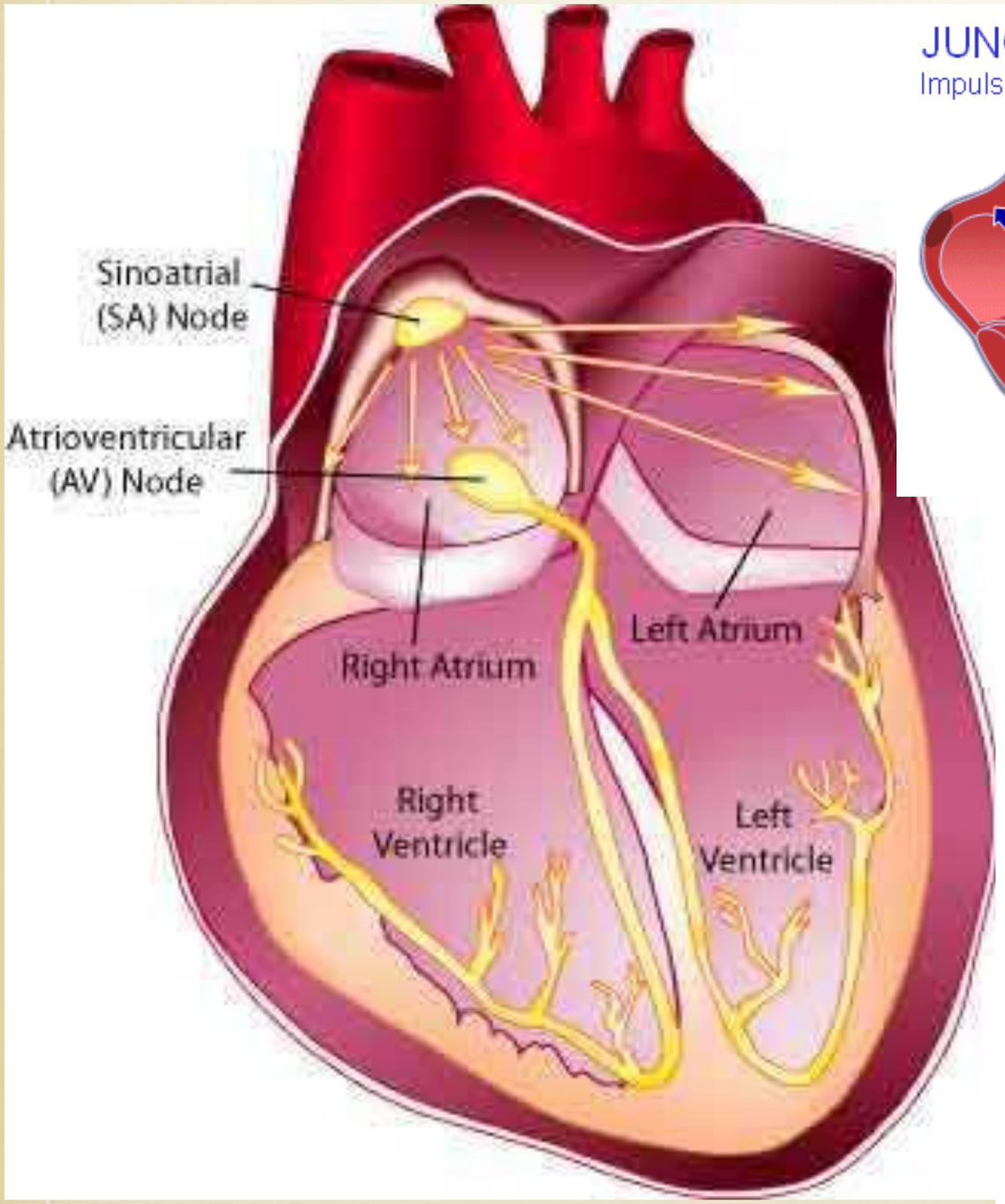


Atrial Fibrillation

Rhythm Practice !

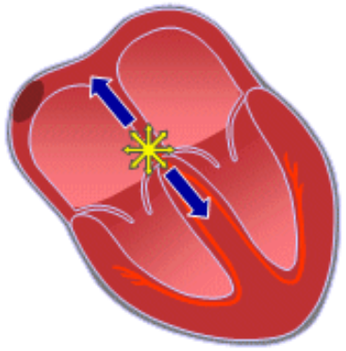


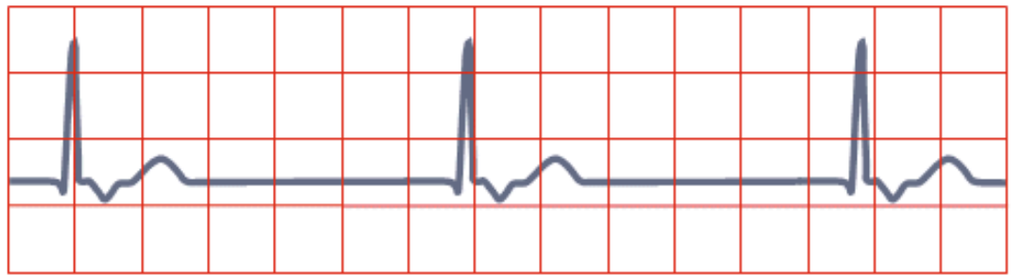
Rhythm
Junctional rhythm !



JUNCTIONAL RHYTHM

Impulses originate at AV node with retrograde and antegrade direction



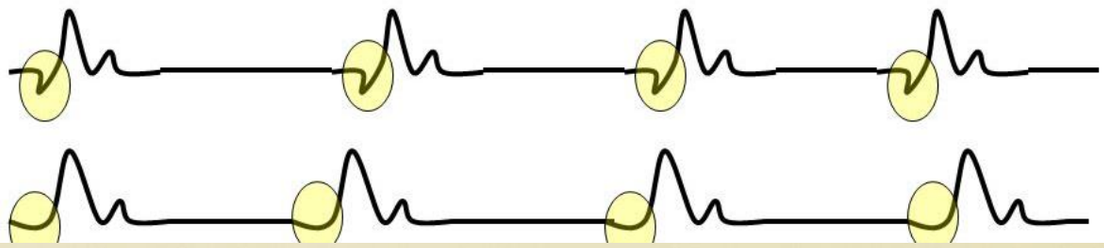


P-wave is often inverted, may be under or after QRS complex
Heart rate is slow

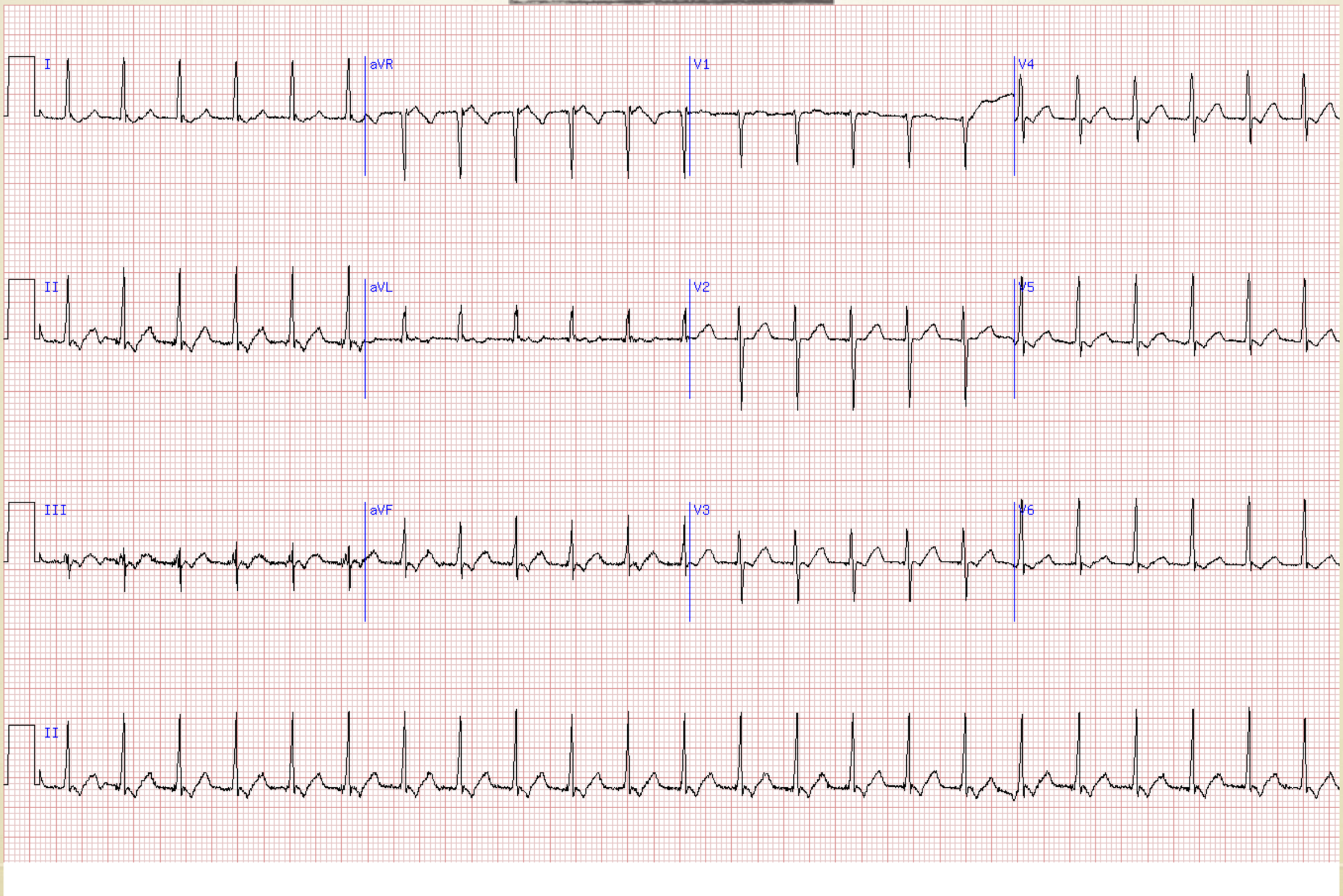
SLOW ARRYHMIAS

- **Sinus Bradycardia**
- *SLOW **sinus** rhythm*

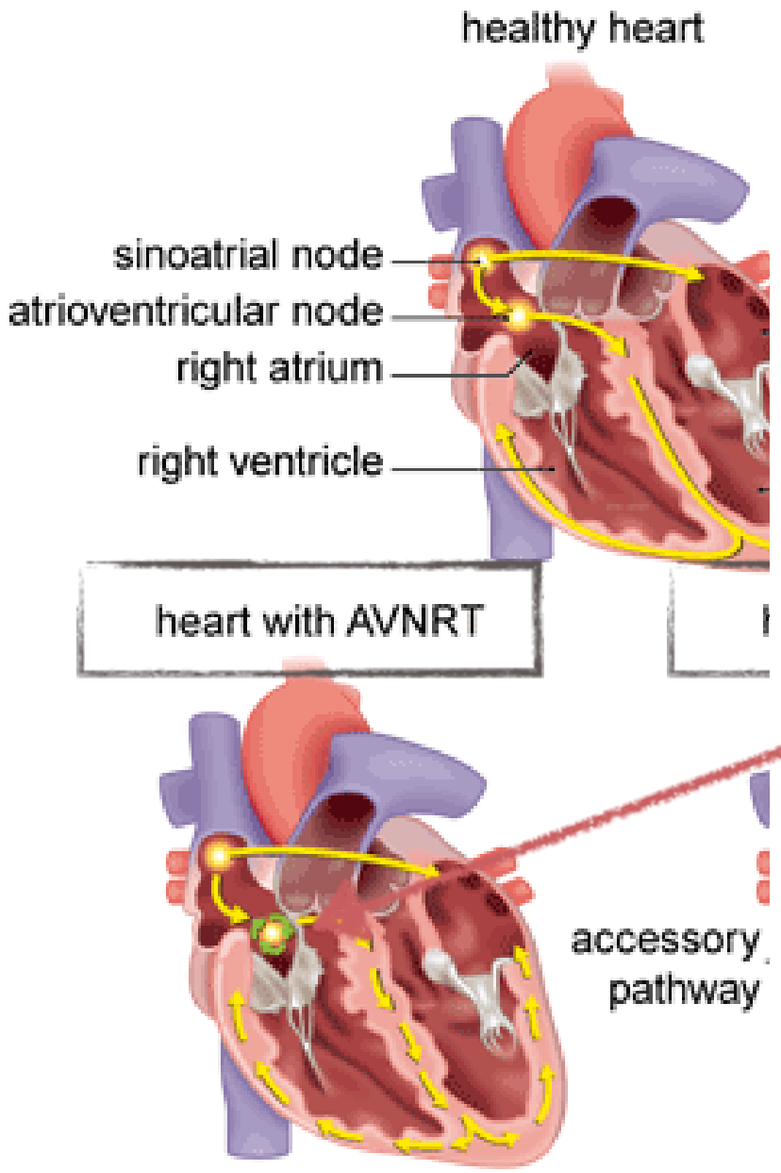
- **Junctional Rhythm**
- *"P" wave is* **inverted** *or* ***absent***

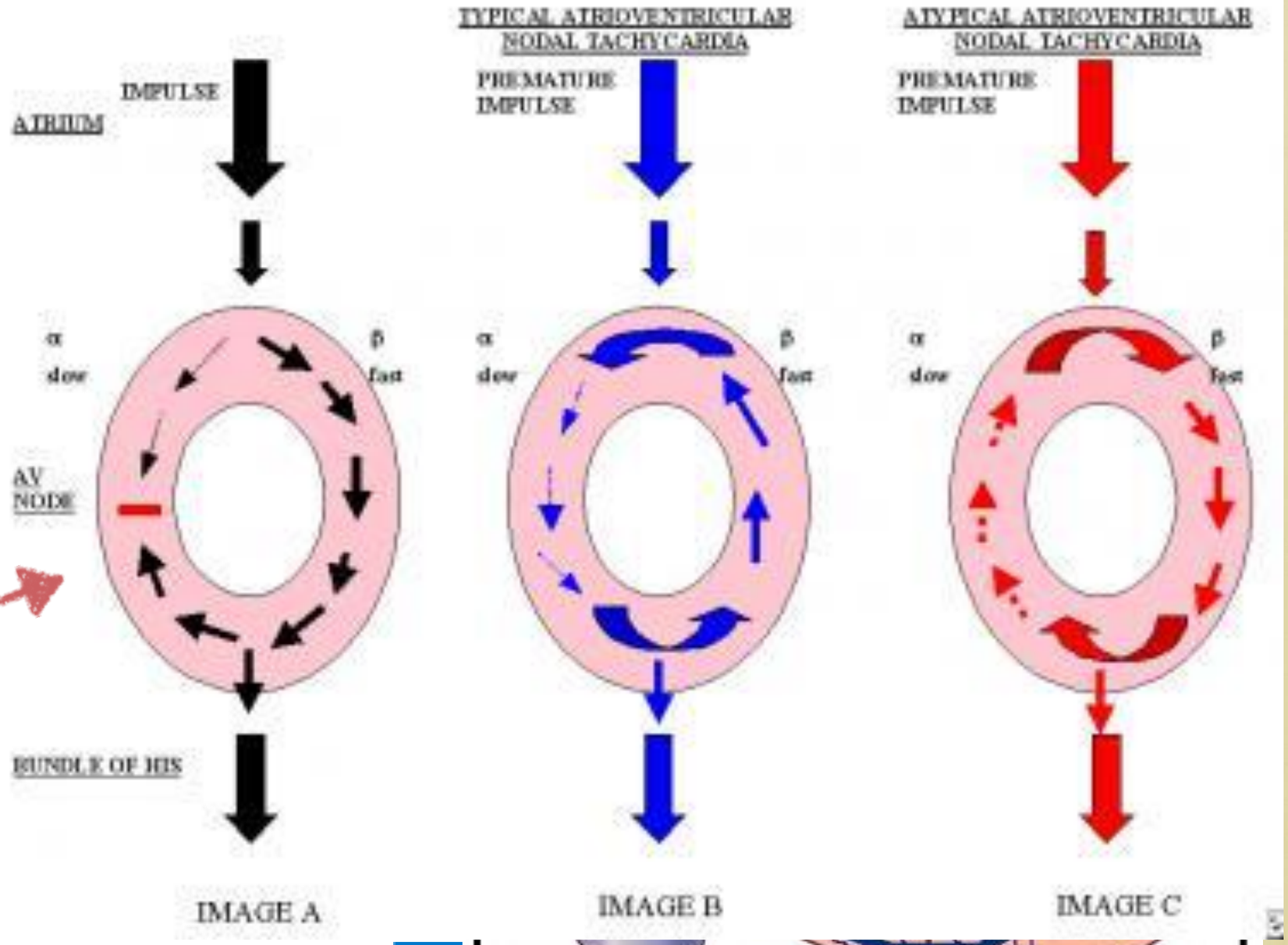


Rhythm Practice !

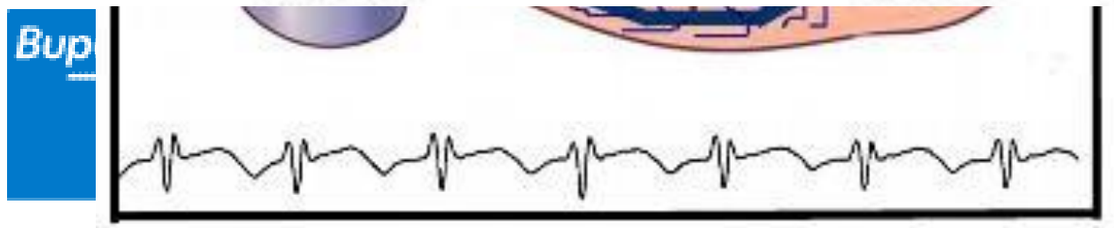


Rhythm
SVT!

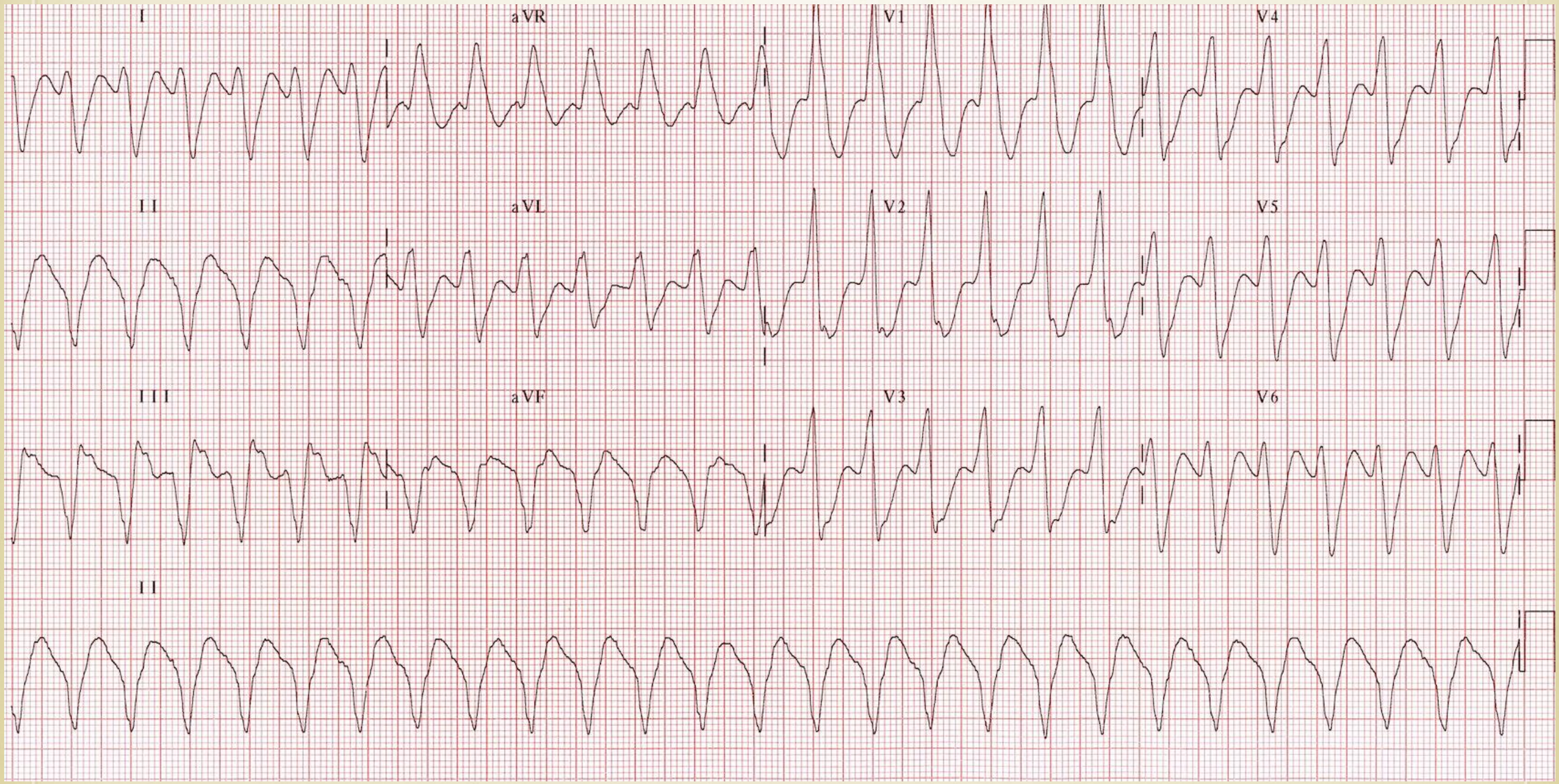




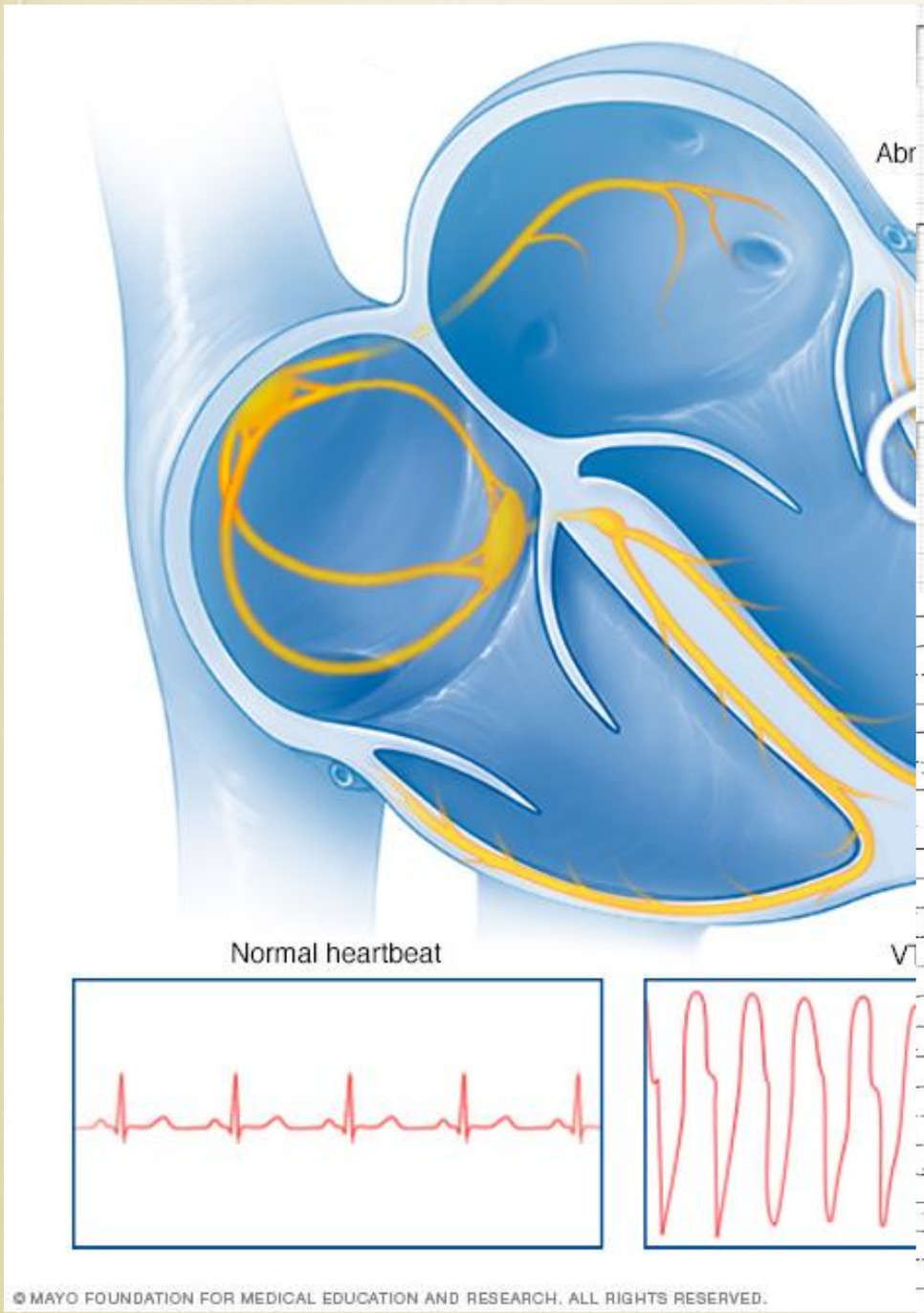
The electrical impulses in a normal heart, a heart with atrioventricular nodal re-entrant tachycardia (AVNRT) and a heart with atrioventricular re-entrant tachycardia (AVRT)

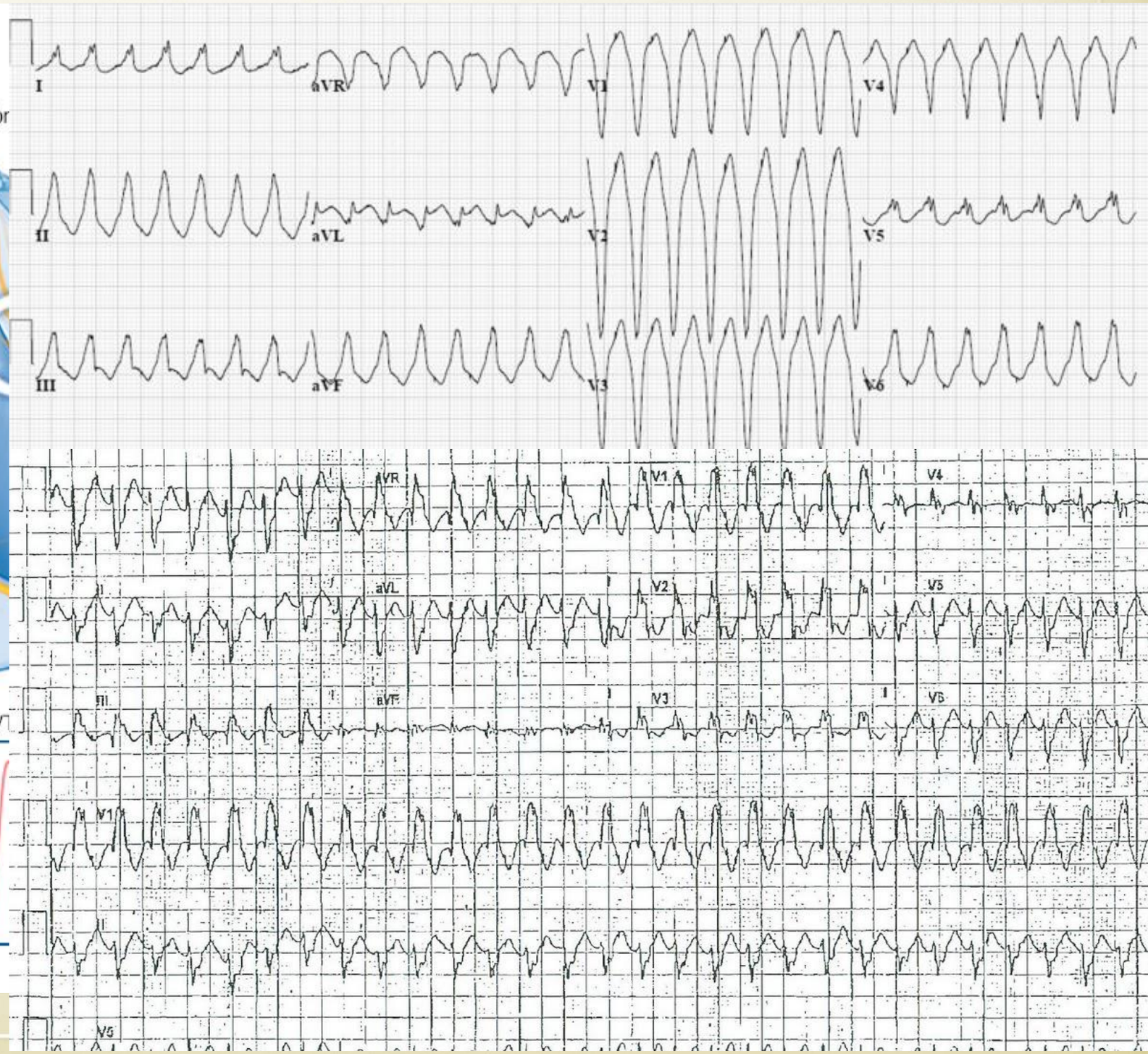


Rhythm Practice !



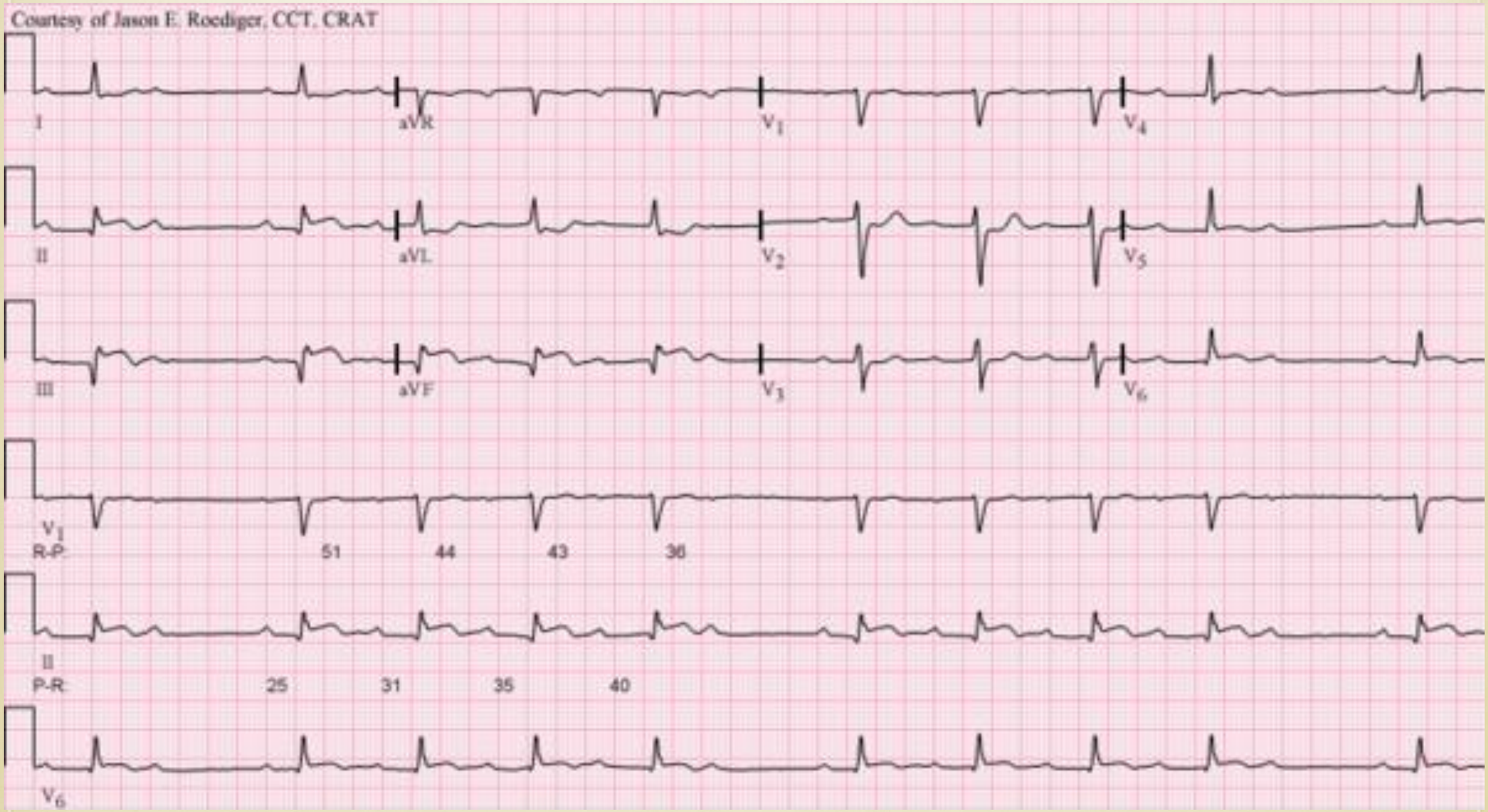
Rhythm
VT!


Abr
Normal heartbeat
V
© MAYO FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH. ALL RIGHTS RESERVED.

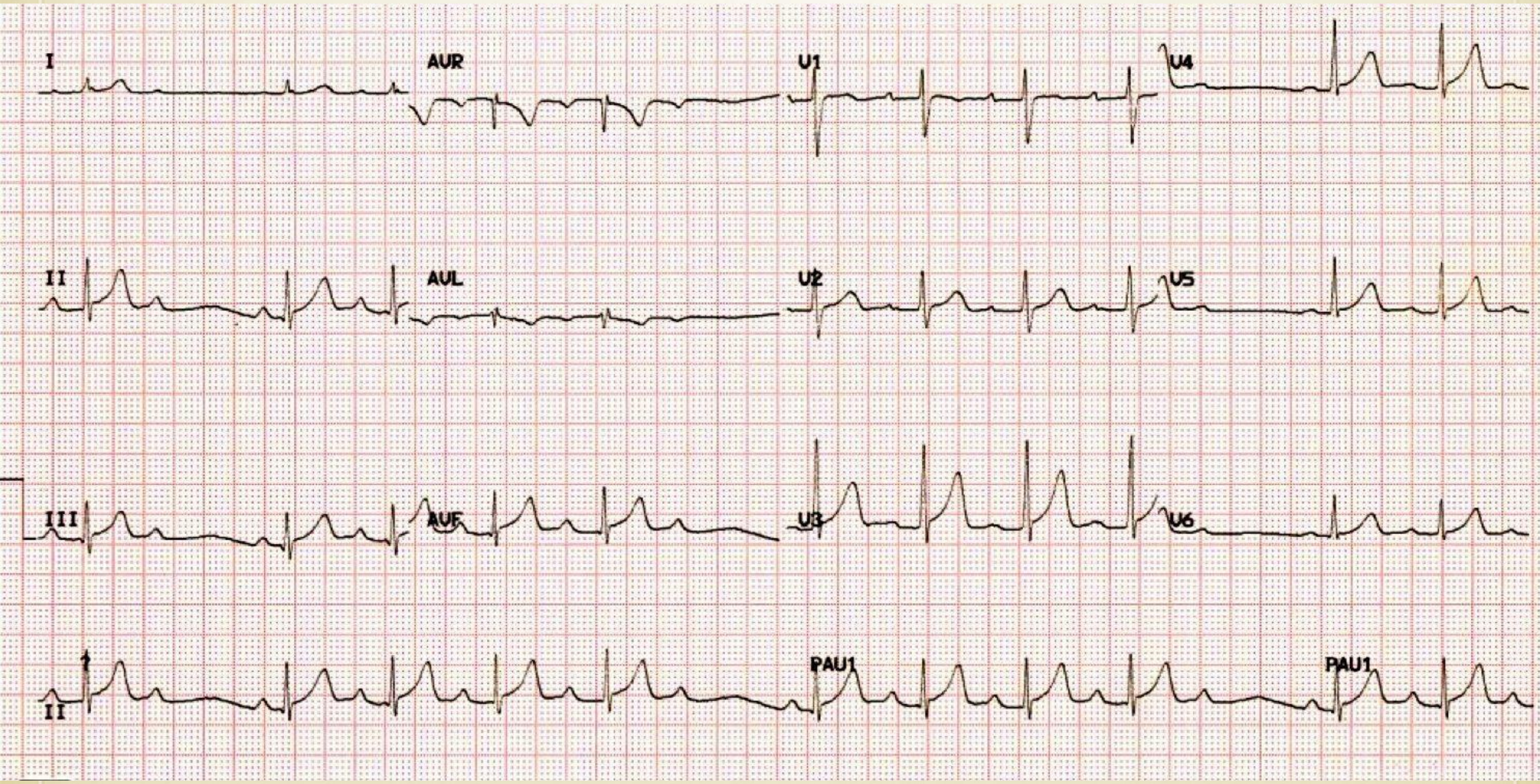

I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V5

Rhythm Practice !

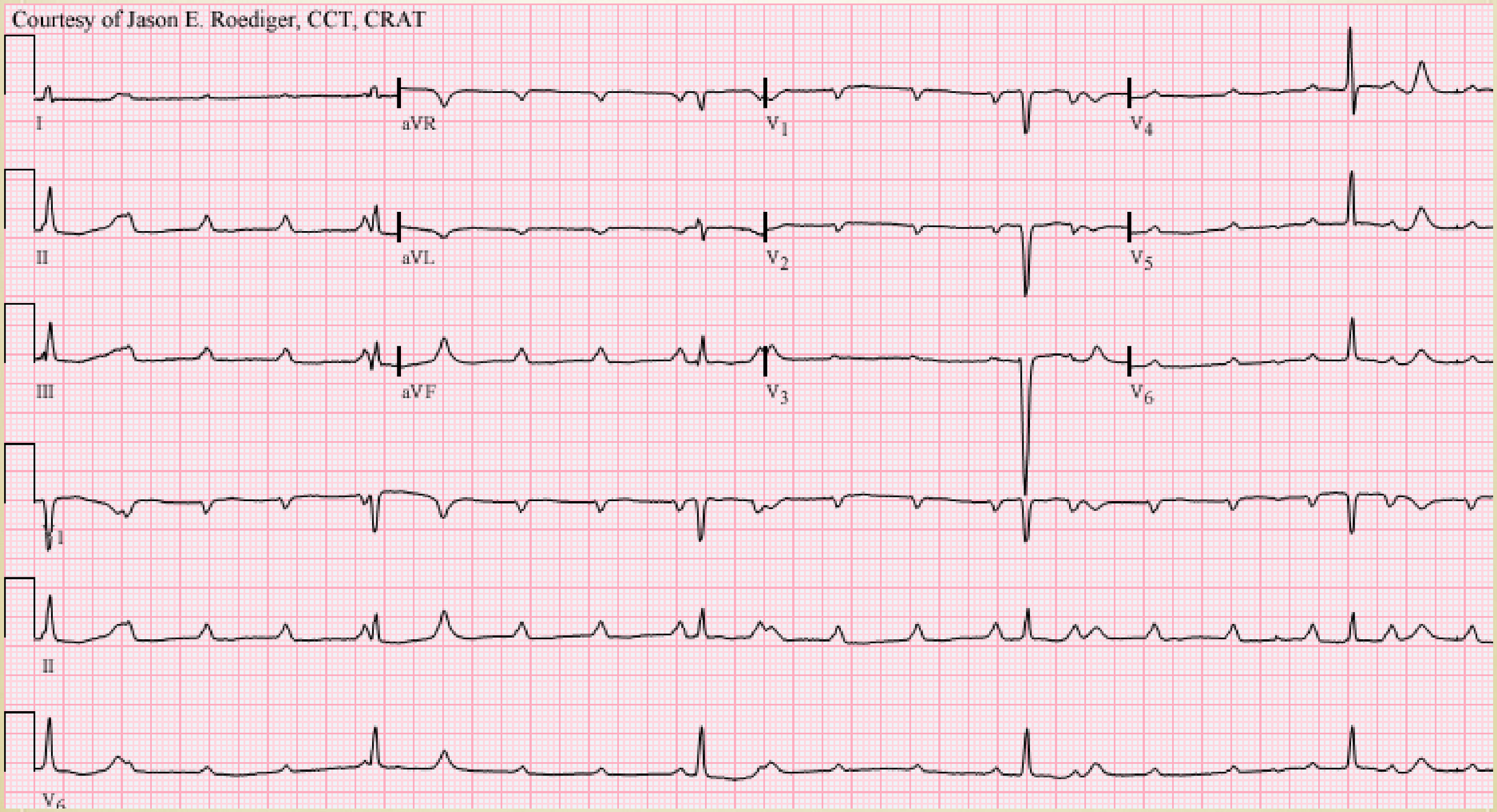
Rhythm Practice !



Rhythm Practice !

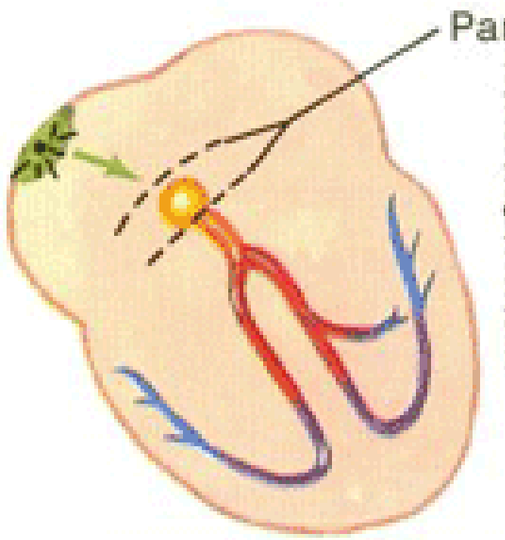


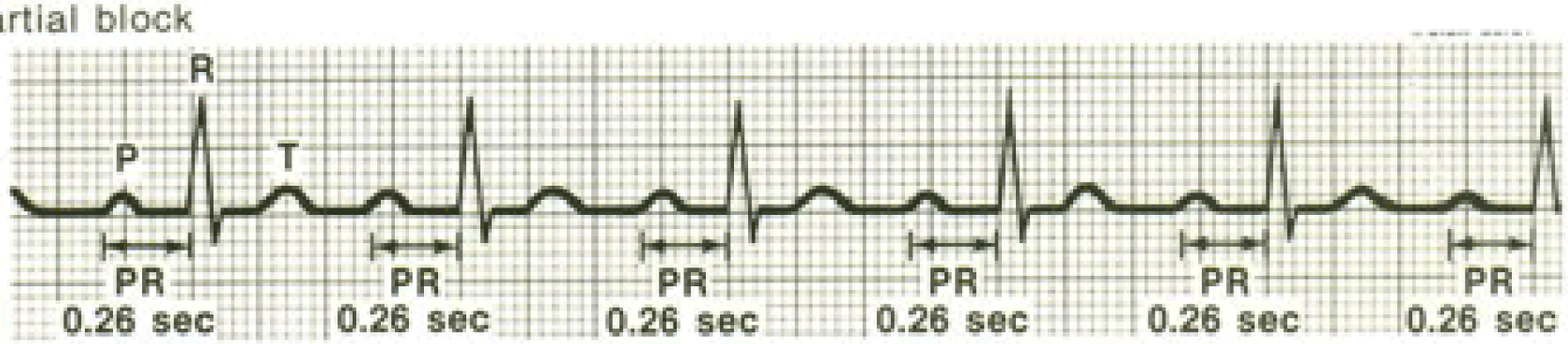
Rhythm Practice !



Atrioventricular Block!

1° AV Block





Rhythm: regular

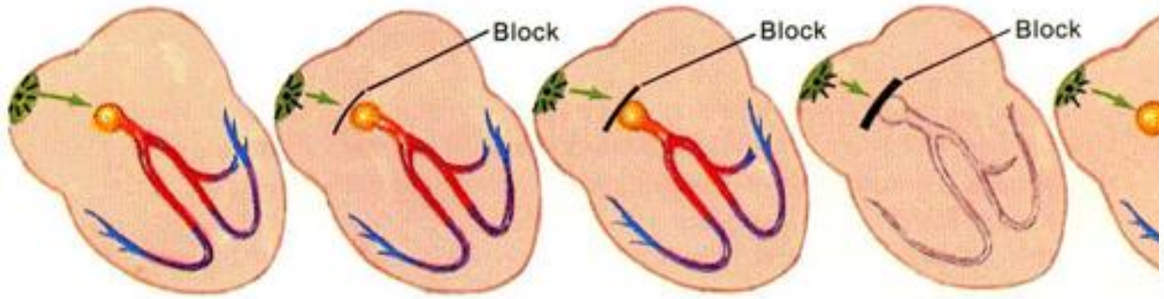
Rate: (that of underlying rhythm)

PRI is > than .2 seconds

QRS: usually normal

Atrioventricular Block!

2° AV Block Mobitz I



P Waves look Similar!

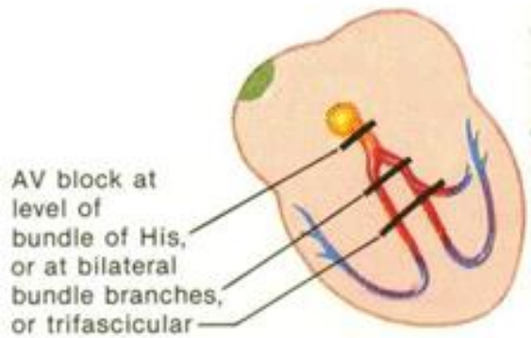
Successively longer PRIs until one QRS f

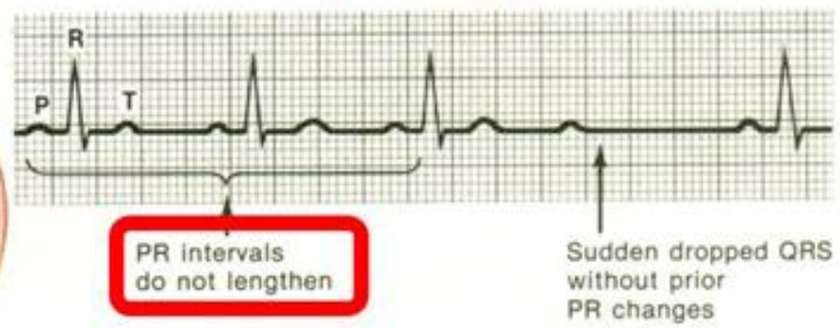
Rhythm (ventricular) is often irregular

Atrial rhythm is ~ **regular,** QRS is normal

2° AV Block Mobitz II

Suddenly dropped QRS





P waves are punctual and similar, **unlike a non-conducted PAC which is EARLY!**

Ventricular rhythm = irregular, atrial rhythm is regular

PRI normal or prolonged

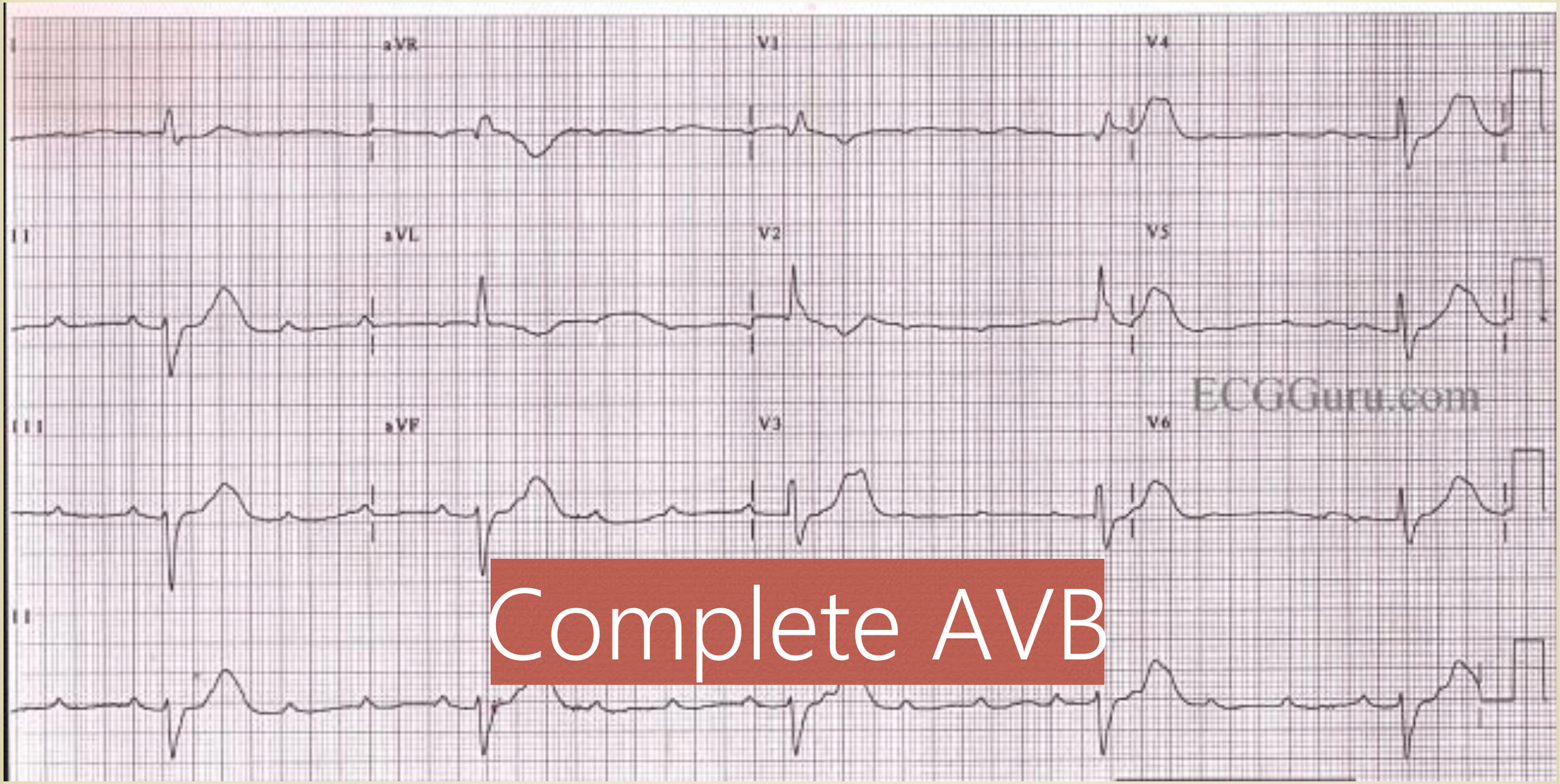
QRS: often abnormal

3° AV Block

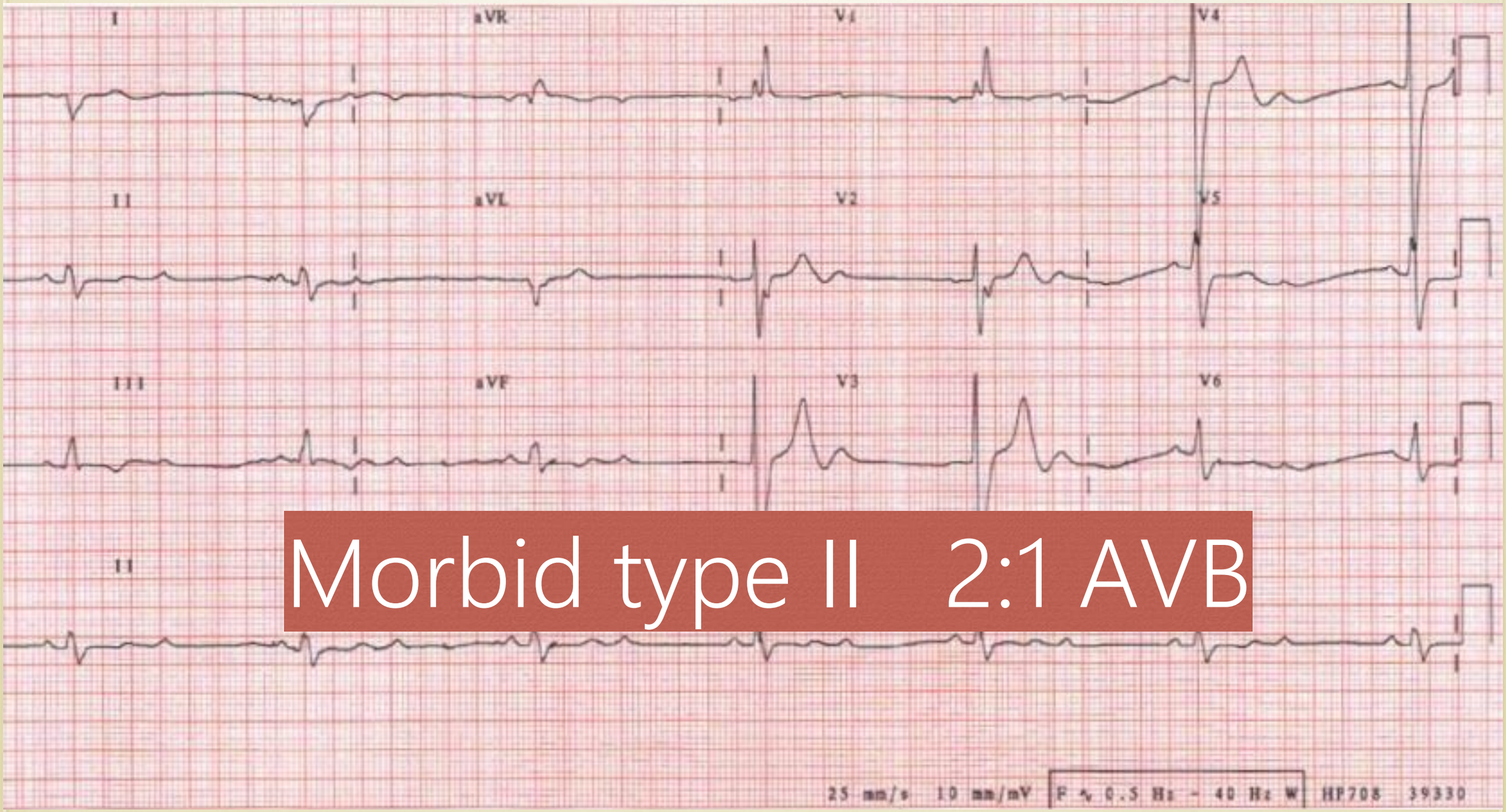
Atria and Ventricles are depolarizing independently

No association between atria & ventricles

Rhythm Practice !

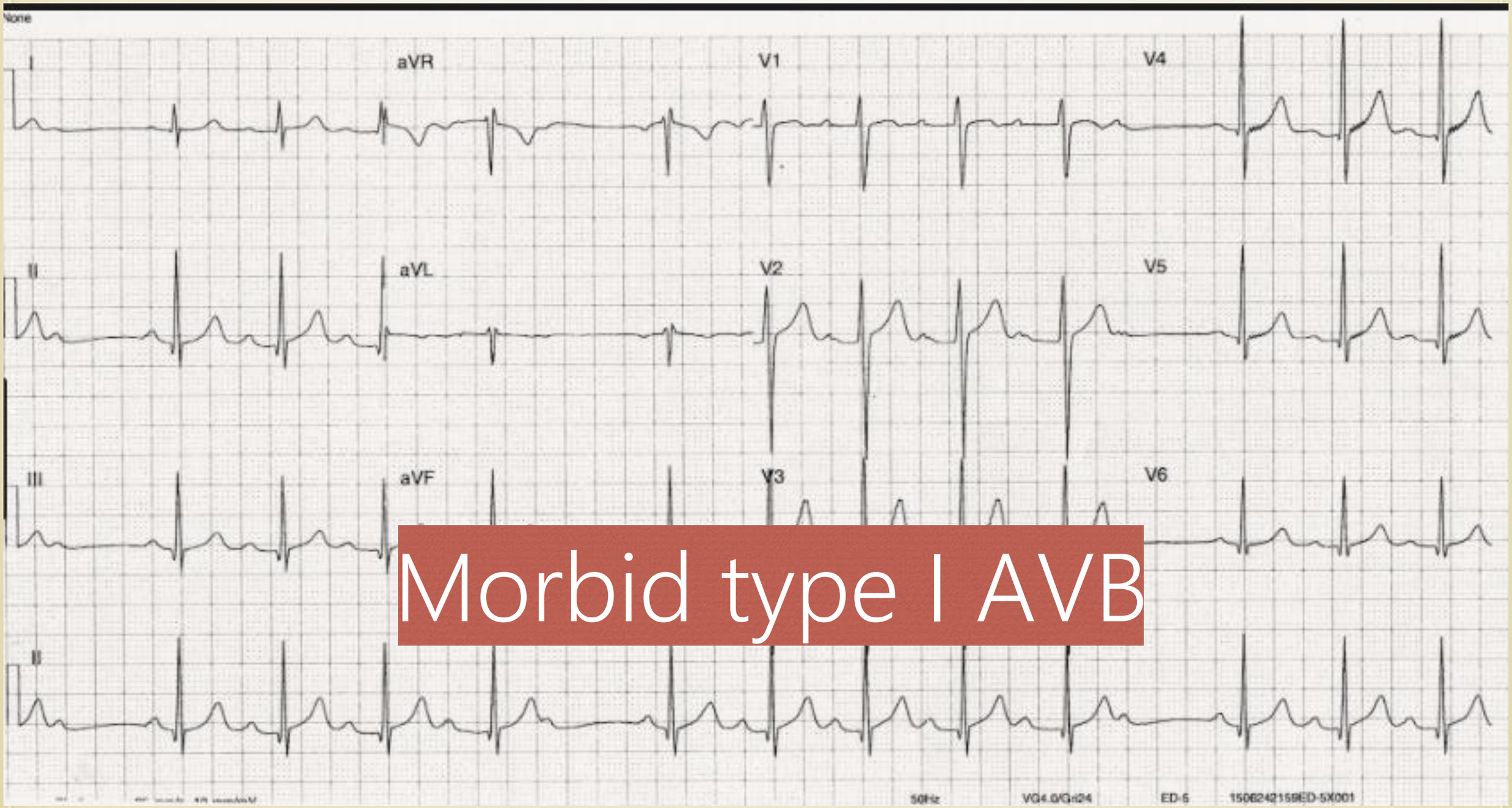


Rhythm Practice !



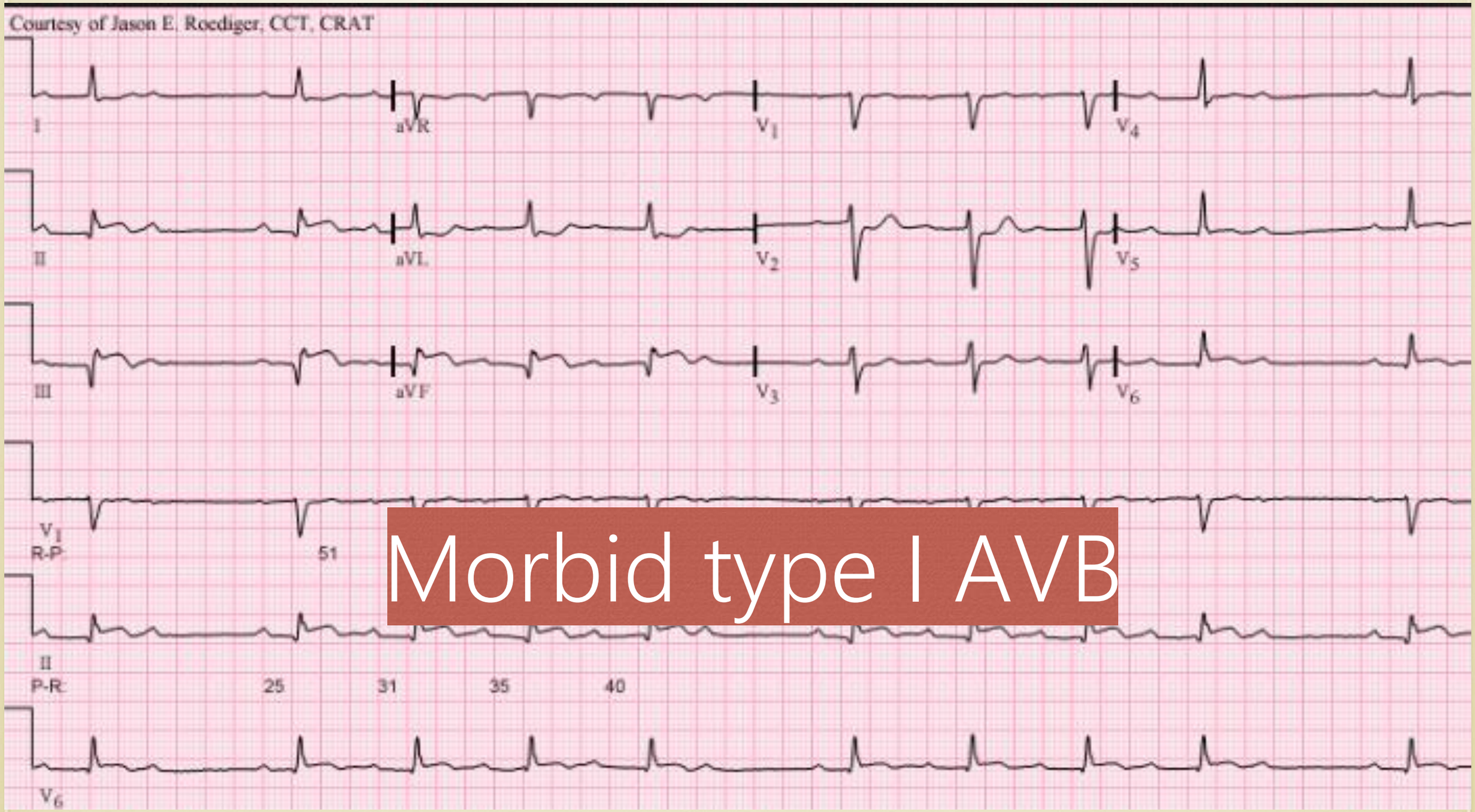
Morbid type II 2:1 AVB

Rhythm Practice !



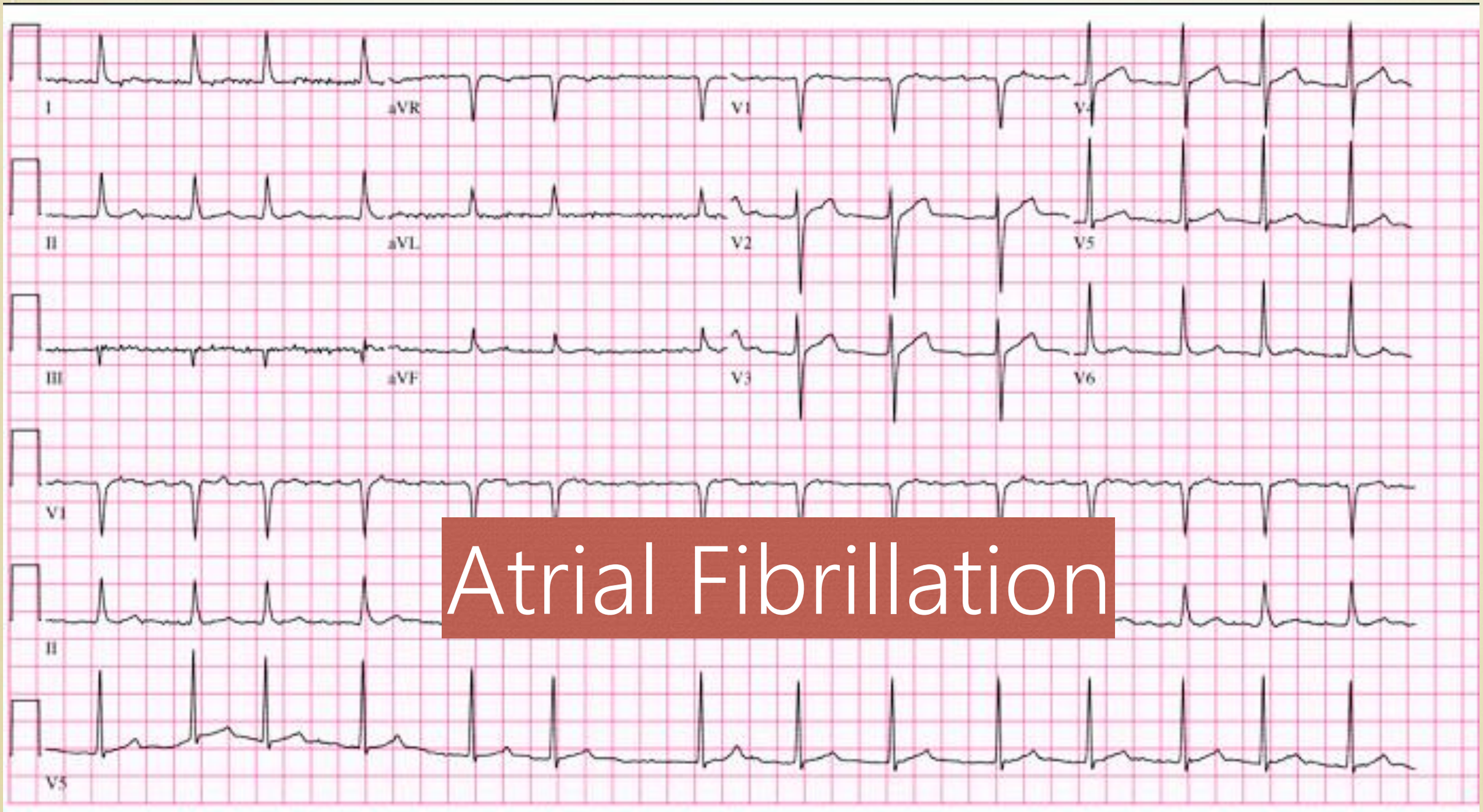
Morbid type I AVB

Rhythm Practice !



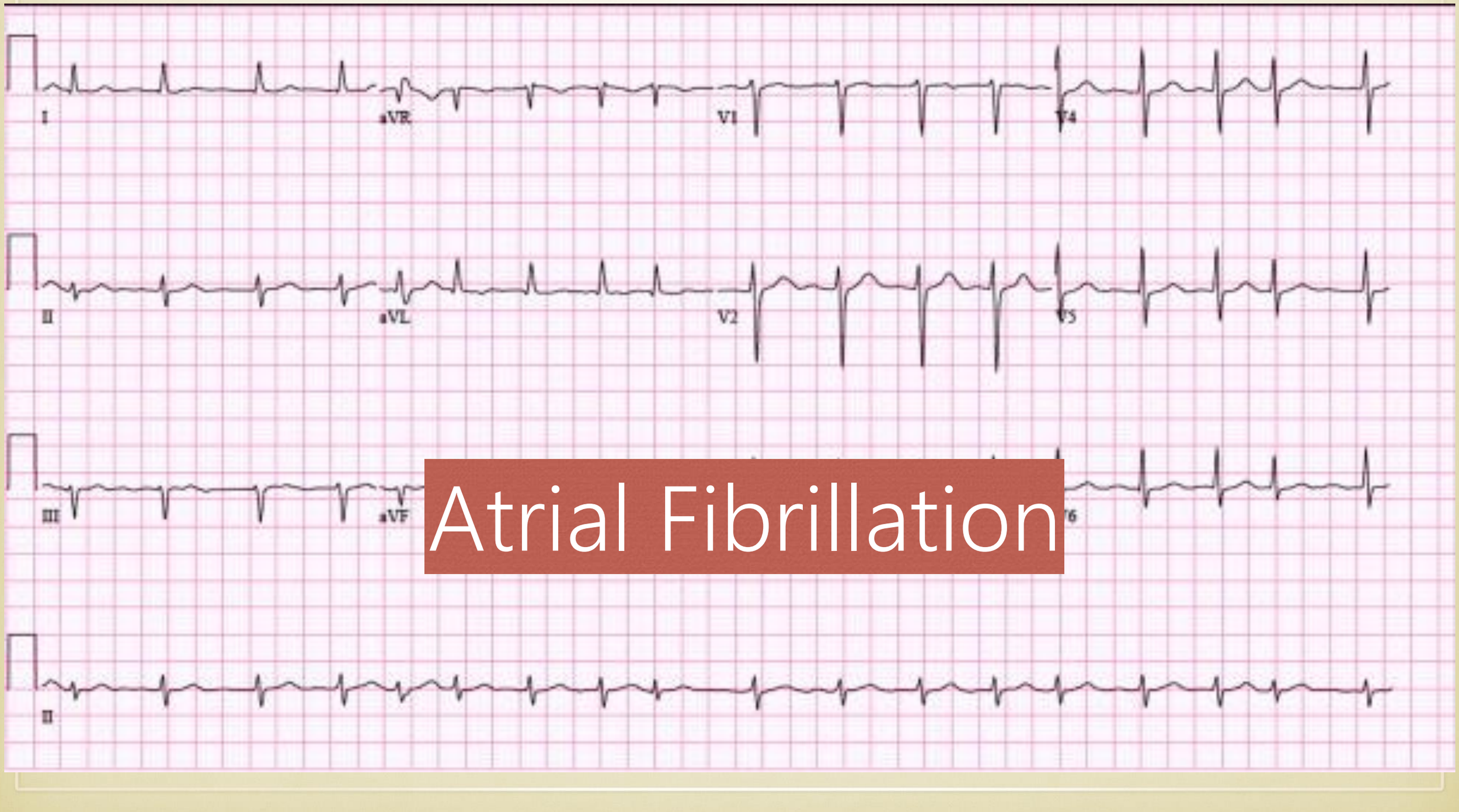
Morbid type I AVB

Rhythm Practice !



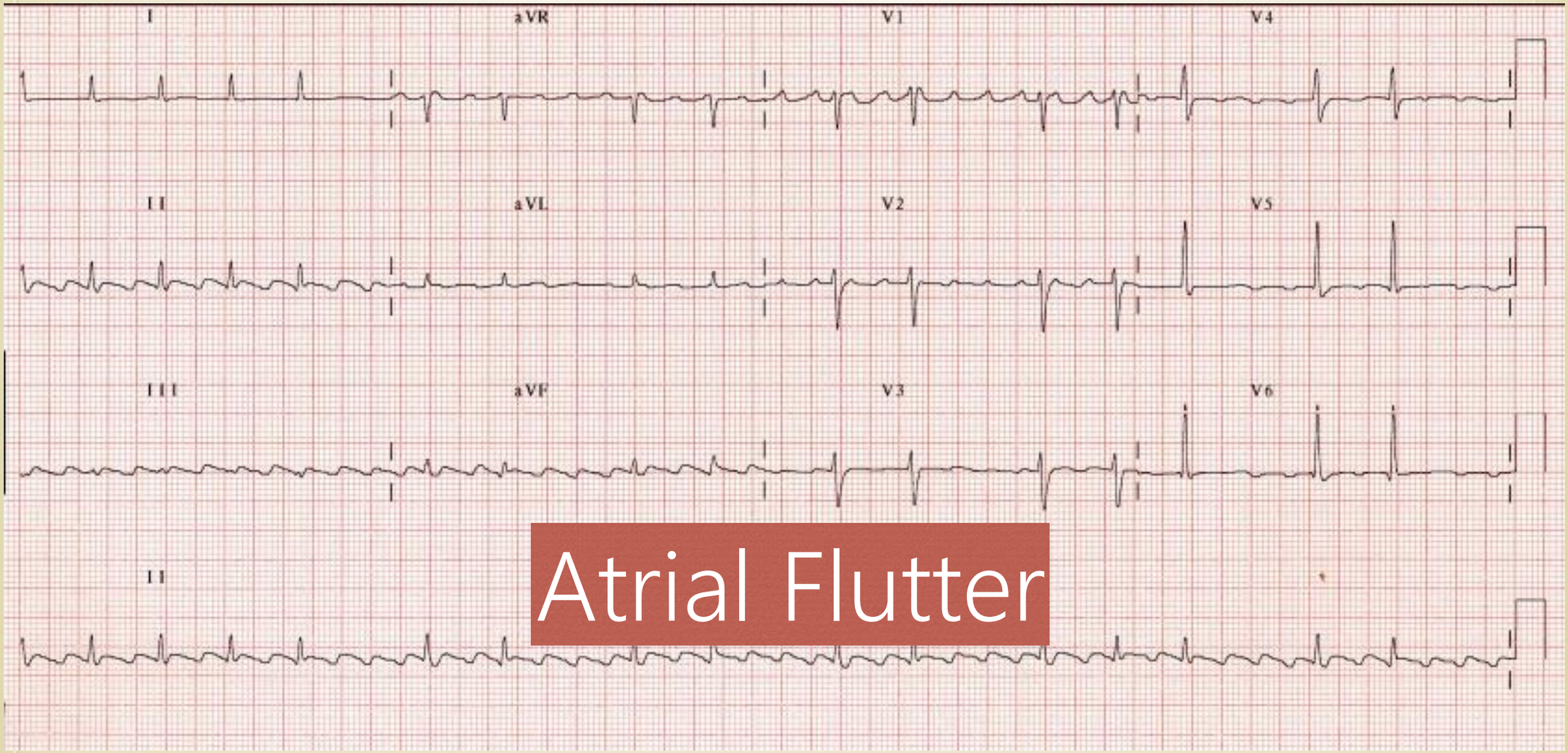
Atrial Fibrillation

Rhythm Practice !



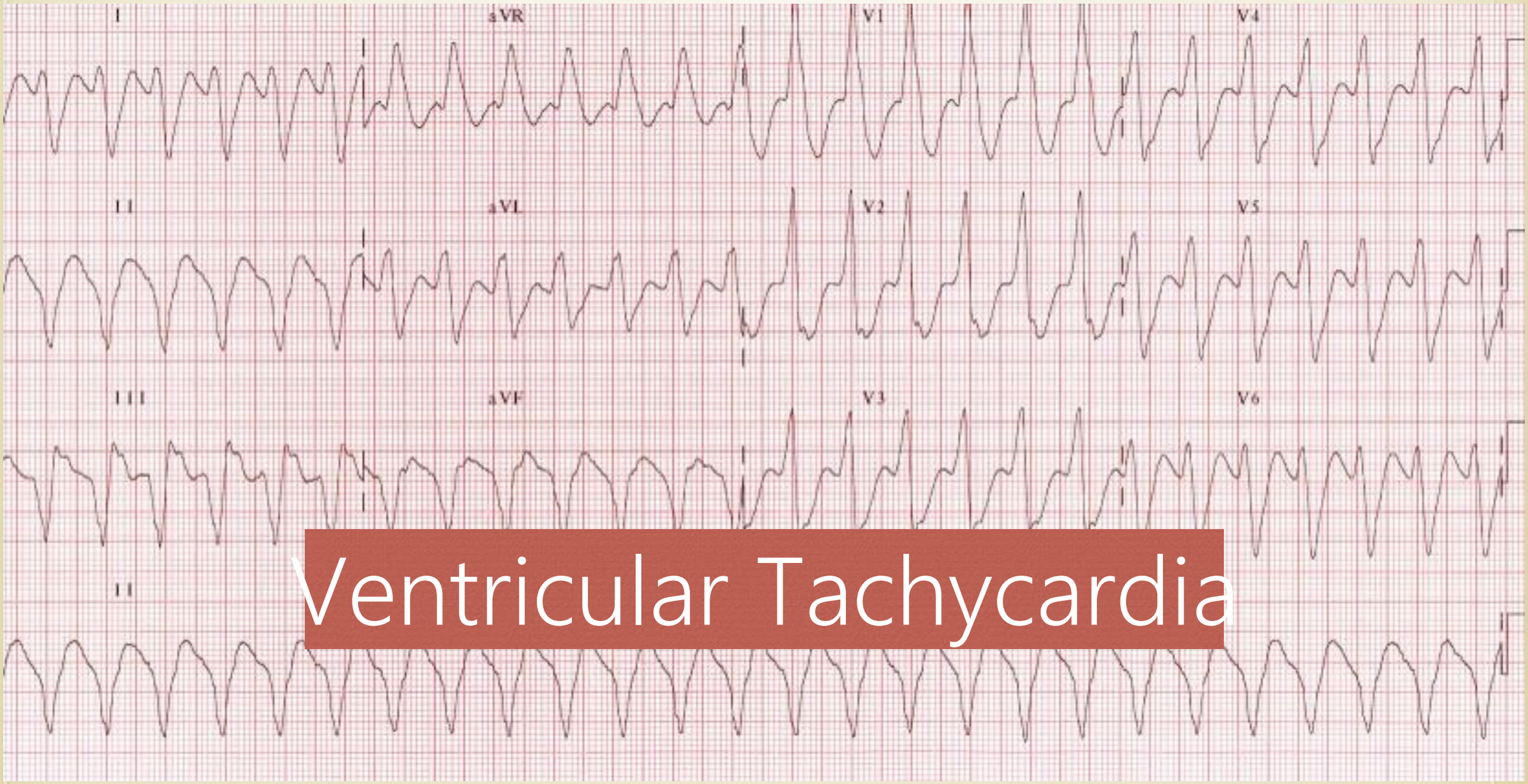
Atrial Fibrillation

Rhythm Practice !



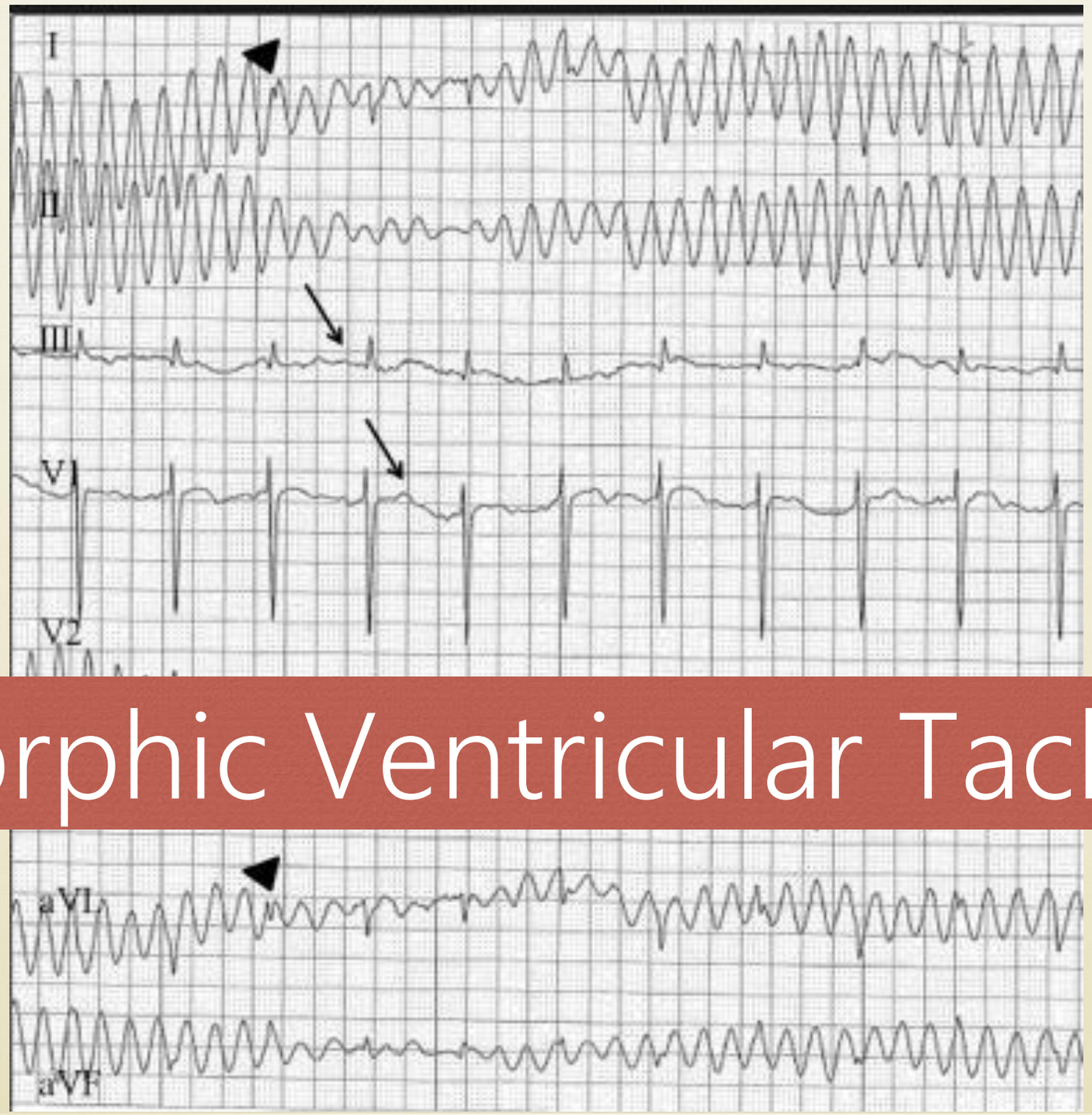
Atrial Flutter

Rhythm Practice !



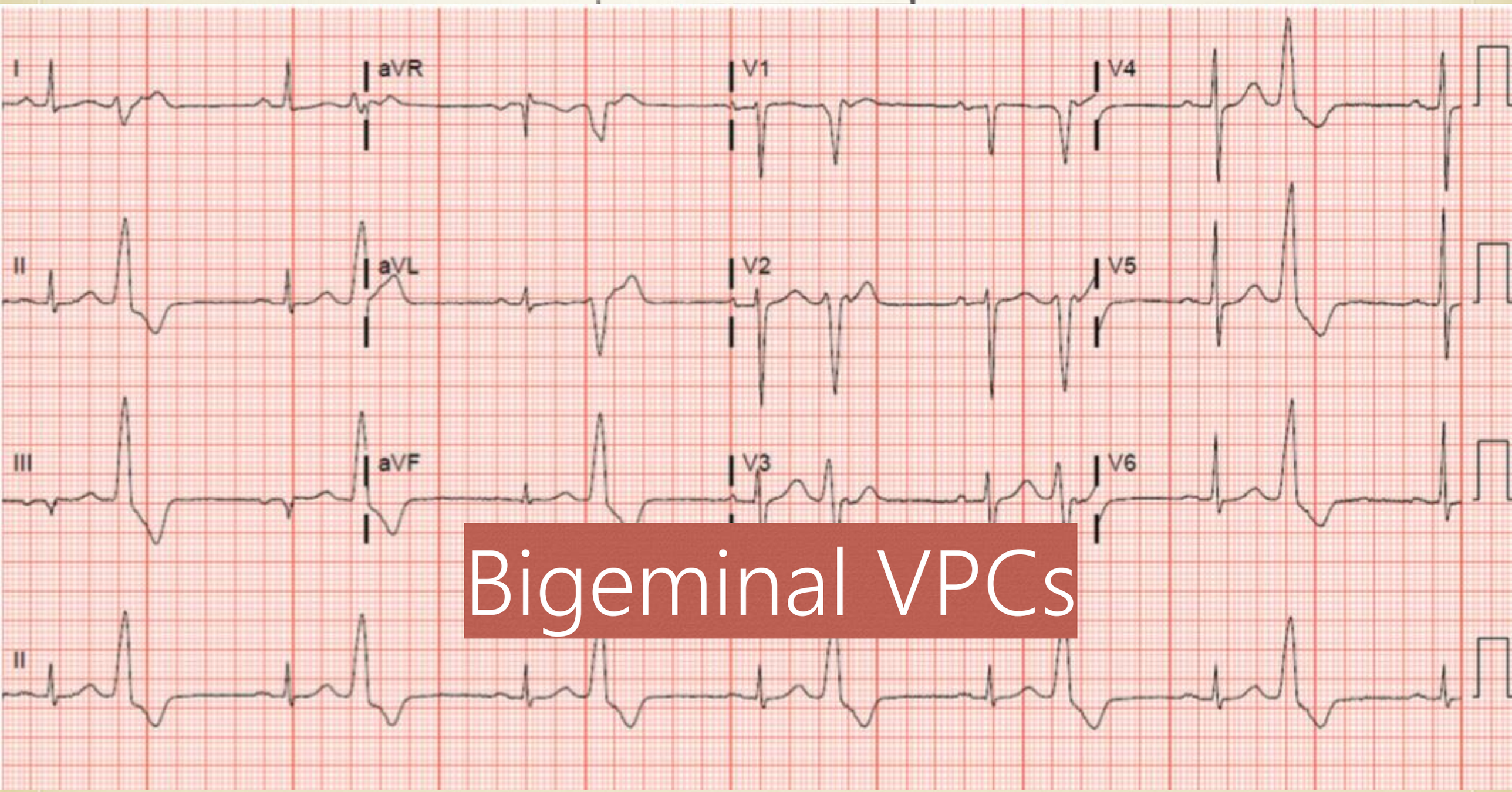
Ventricular Tachycardia

Rhythm Practice !



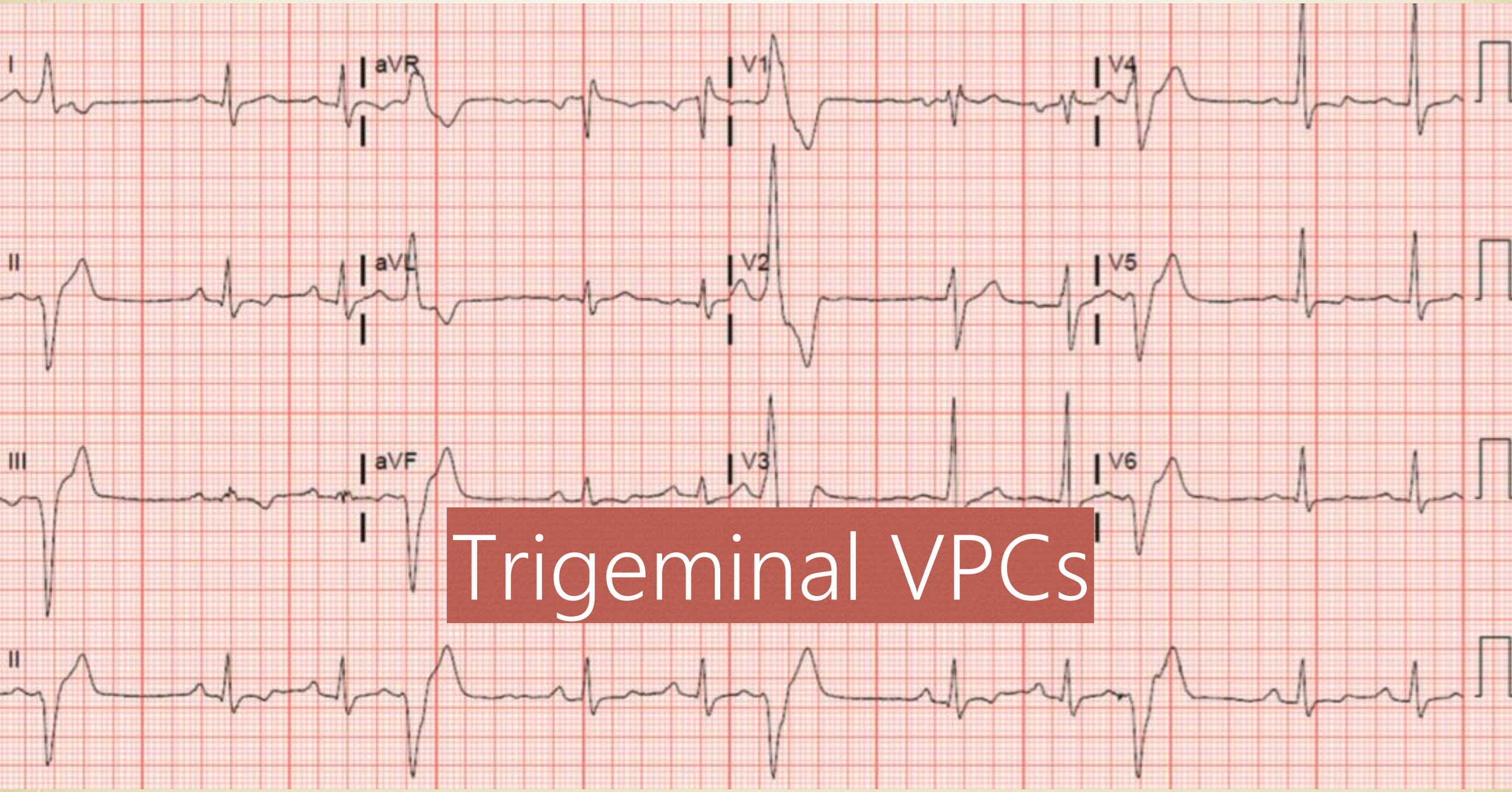
Polymorphic Ventricular Tachycardia

Rhythm Practice !



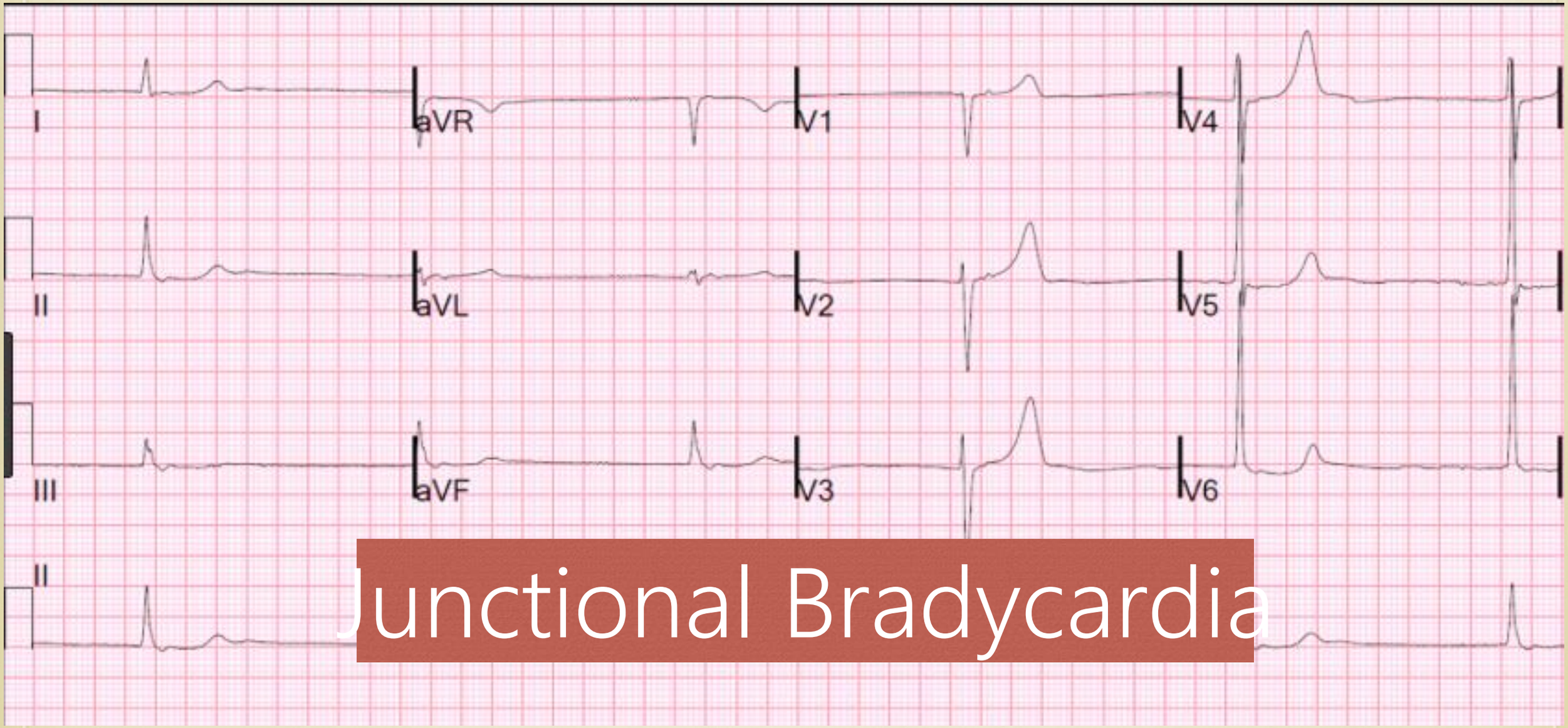
Bigeminal VPCs

Rhythm Practice !



Trigeminal VPCs

Rhythm Practice !



Junctional Bradycardia

建議判讀順序

Chambers
STT changes
Others: QTC, hyperK, hypoCa…

Left ventricular hypertrophy (LVH)
Right ventricular hypertrophy (RVH)
Left atrial enlargement (LAE)
Right atrial enlargement (RAE)

Chambers
LVH

Common electrocardiographic criteria for the diagnosis of left ventricular hypertrophy (LVH)

Cornell voltage criteria

SV3 + RaVL ≥ 2.0 mV (28 mm) in men
SV3 + RaVL ≥ 2.8 mV (20 mm) in women
(some variations use a lower cutoff value in men)

Cornell product criteria

SV3 + RaVL (+8 in women) (a) x QRS duration ≥ 2,440 mm × ms

Sokolow-Lyon voltage criteria

SV1 + RV5 or RV6 ≥ 3.5 mV (35 mm) (b)or RaVL ≥ 1.1 mV (11 mm)

Romhilt-Estes point score system

(a score ≥ 5 is diagnostic of LVH, a score of 4 is "probable" LVH)
Voltage criteria (3 points):
Any S or R in limb leads ≥ 20 mm , SV1, SV2, RV5, or RV6 ≥ 30 mm
ST-T wave changes of LVH (3 points, 1 point on digitalis)
Left atrial abnormality (3 points):Terminal component of the P wave in V1 ≥ 1 mm and ≥ 40 ms
Left axis deviation (2 points):QRS axis of −30 degrees or more negative
Prolonged QRS duration (1 point):
≥ 90 ms Delayed intrinsicoid deflection time (1 point): ≥ 50 ms in V5 or V6

(a) A modification of +6 instead of +8 in women may be more accurate and was used in the Losartan Intervention for Endpoint Reduction in Hypertension (LIFE) study10

(b) A cutoff value of 38 mm has also been used eg: in the LIFE study

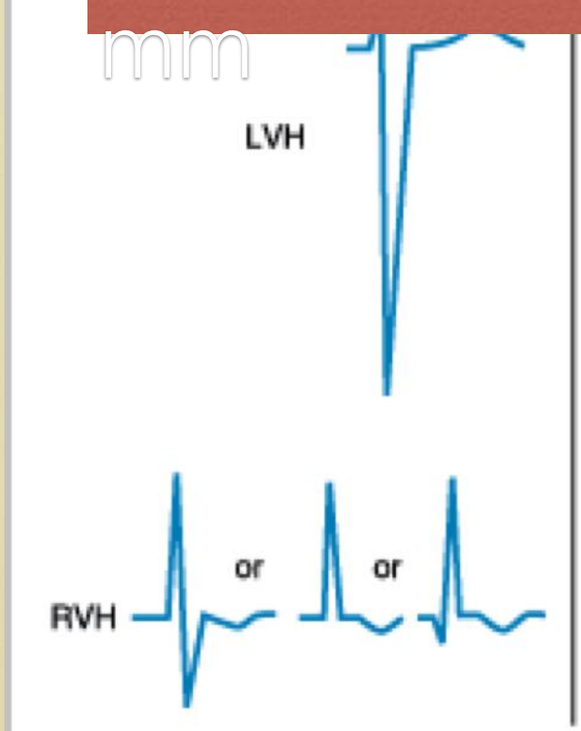
LVH
Sokolow-Lyon voltage criteria

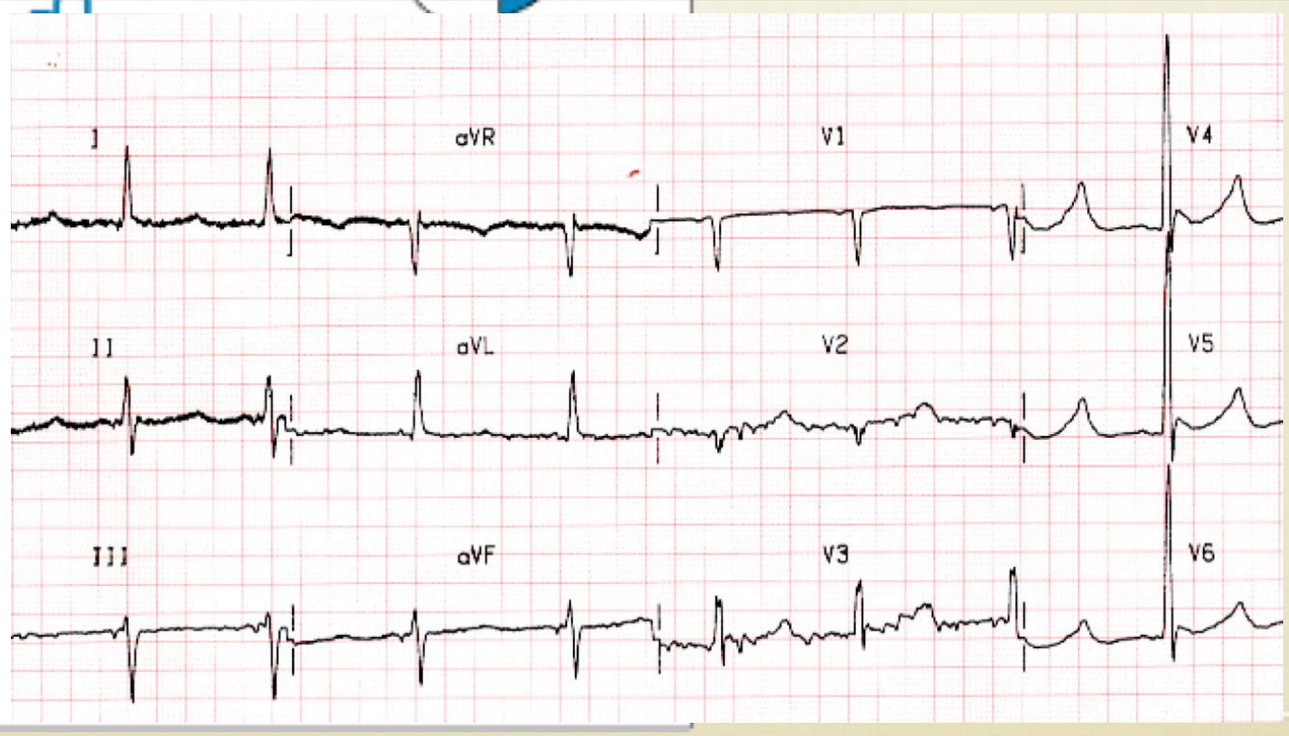
Box 5.3 Sokolow–Lyon Voltage Criteria for LVH Diagnosis

- RI + SIII ≥ 2.5 mV (25 mm)
- R in aVL >1.2 mV (12 mm)
- R in aVF >2.0 mV (20 mm)
- S in V1 >2.4 mV (24 mm)
- R in V5 and V6 >2.6 mV (26 mm)
- R in V5 or V6 + S in V1 >3.5 mV (35 mm)

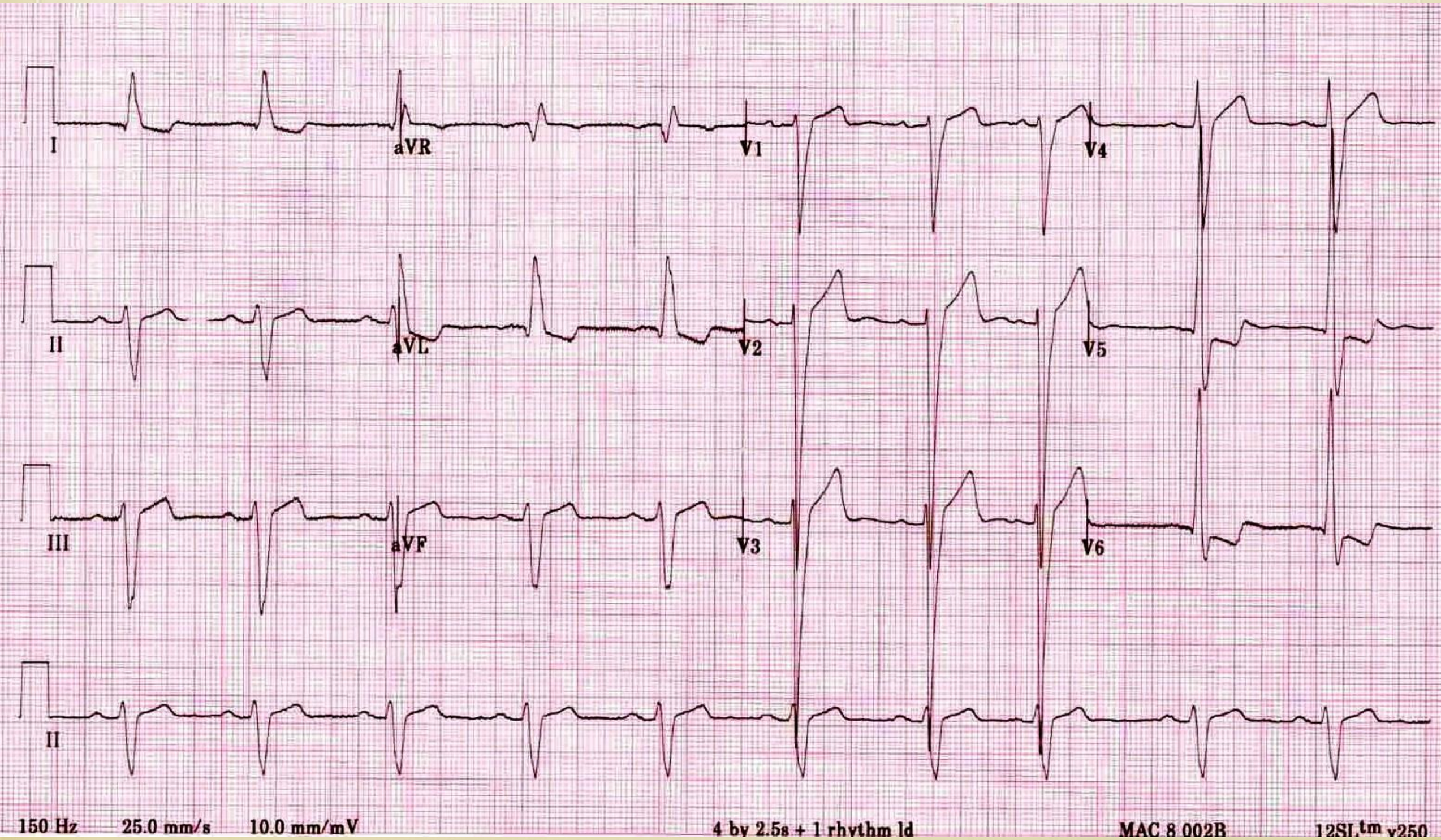
Chambers
LVH-Voltage criteria

R wave in lead I + S wave in lead II > 25 mm
S wave in AVR >14 mm
R wave in AVL > 11 mm
R wave in AVF >20 mm
R wave in V5 or V6 >26 mm
R wave in V5 or V6 plus S wave in V1 >35 mm
Largest R wave + largest S wave in precordial leads > 45 mm





Chambers
LVH



Chambers
RVH

RIGHT VENTRICULAR HYPERTROPHY

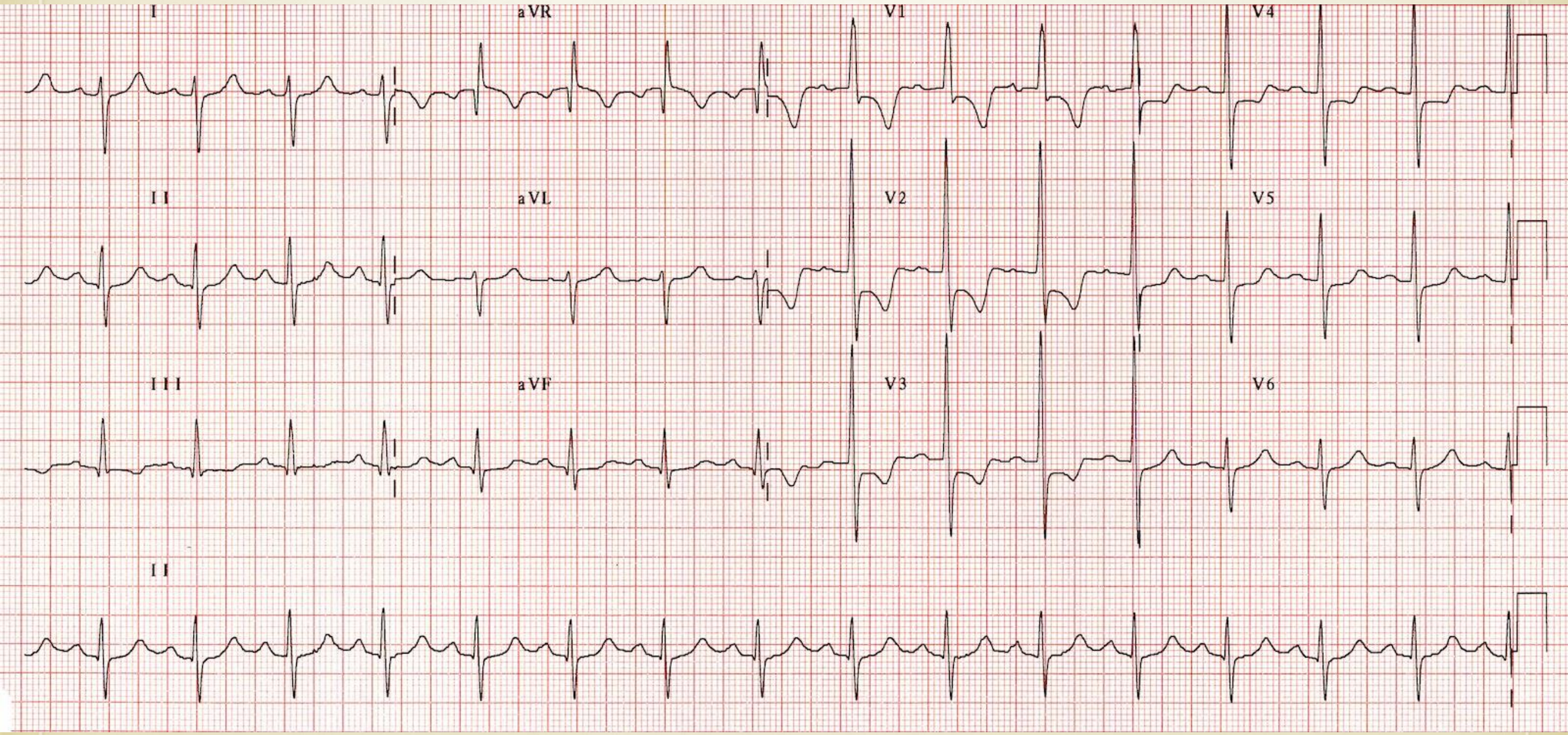
Sokolow-Lyon Criteria:

R in V1 + S in V5-V6 > 11 mm
R in V1 > 7mm
R : S in V1 > 1
RAD > +90 degrees

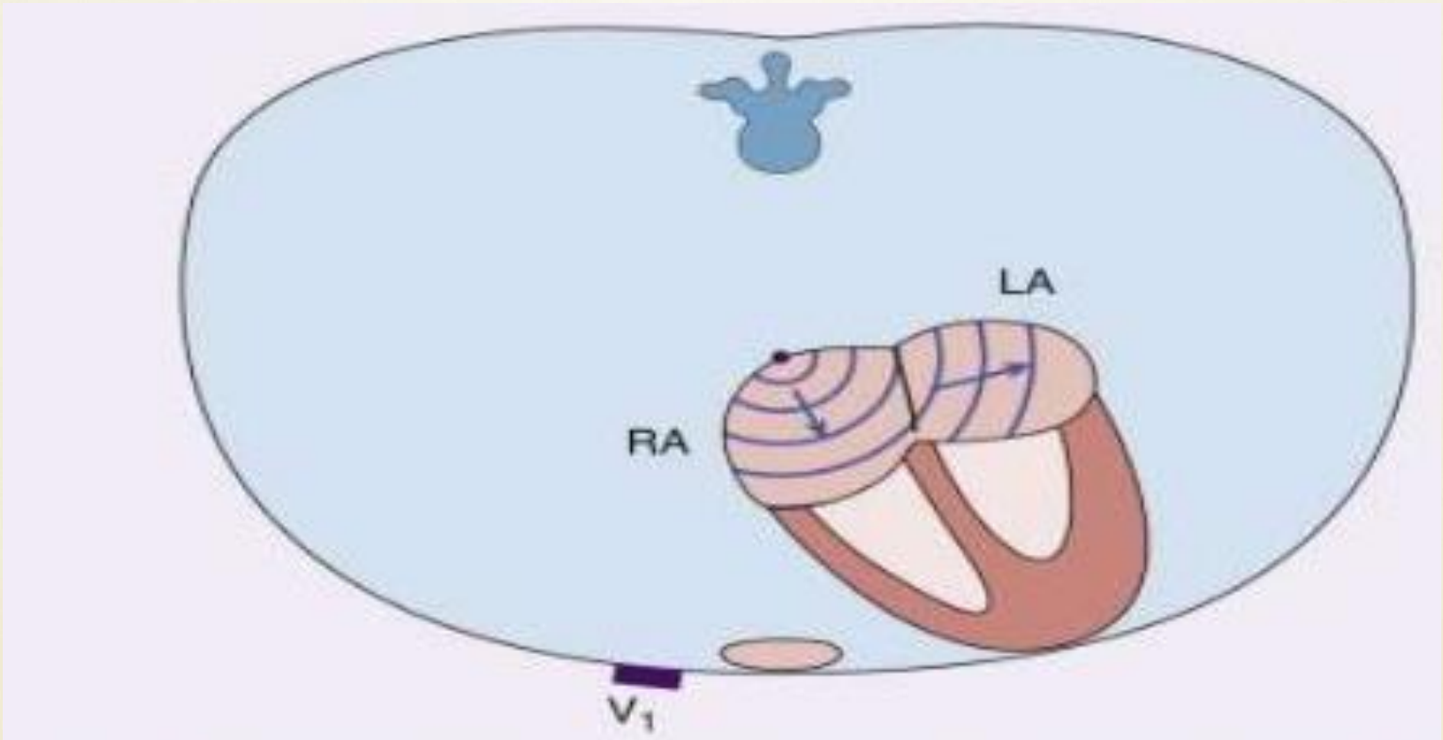
Additional Criteria:

QR in V1
S1 Q3 pattern
S1 S2 S3 pattern
p pulmonale

Chambers
RVH

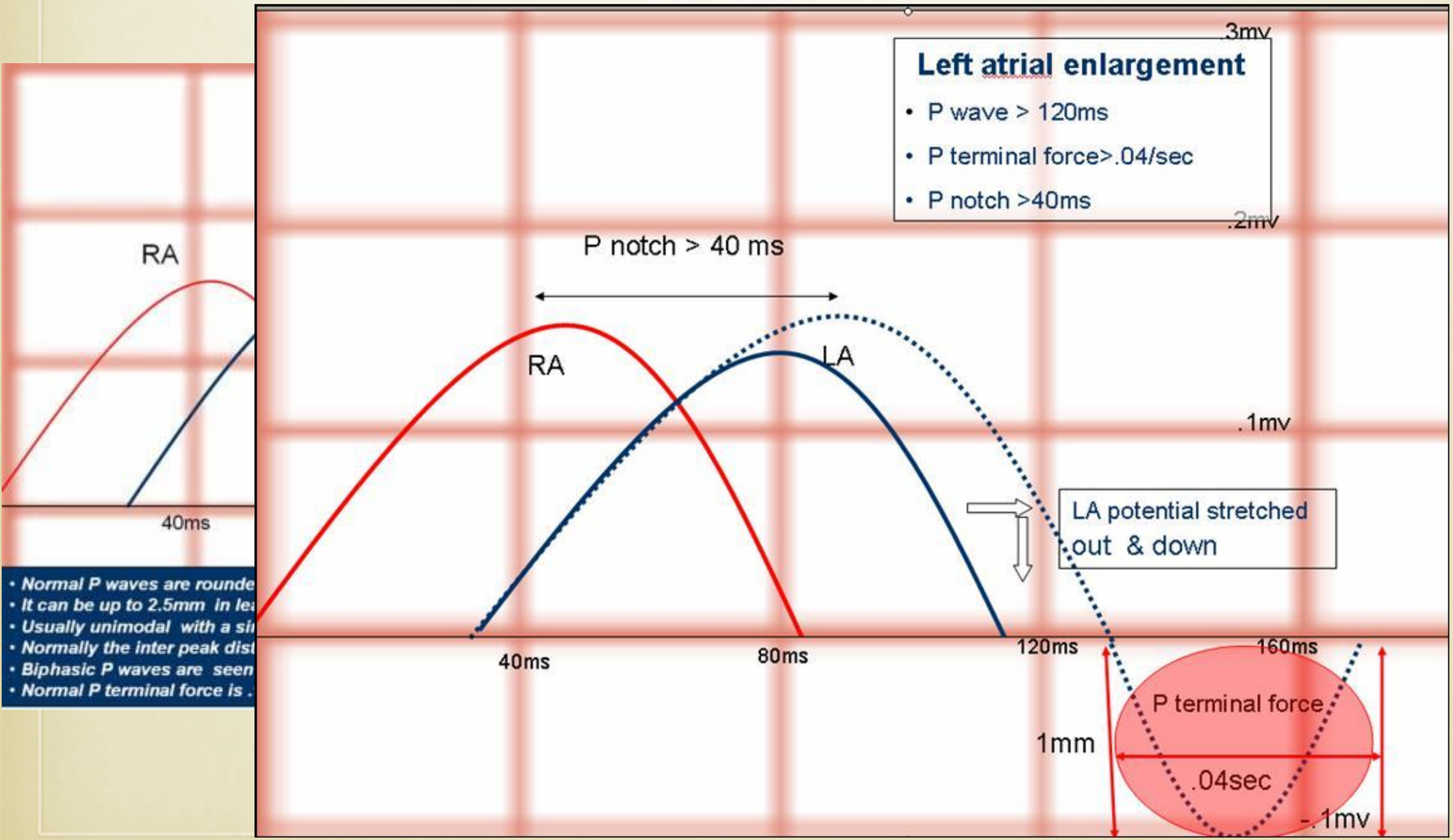


Chambers
LAE & RAE

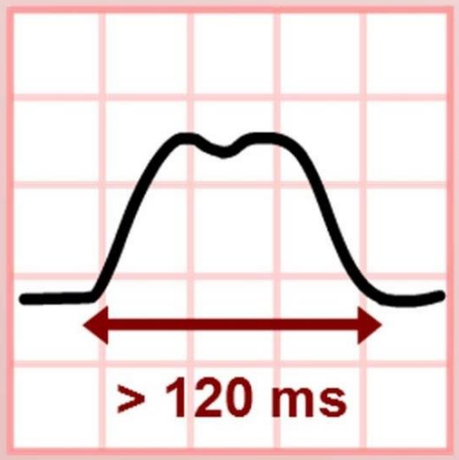
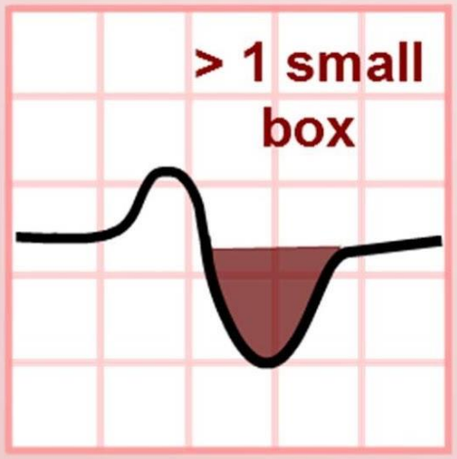
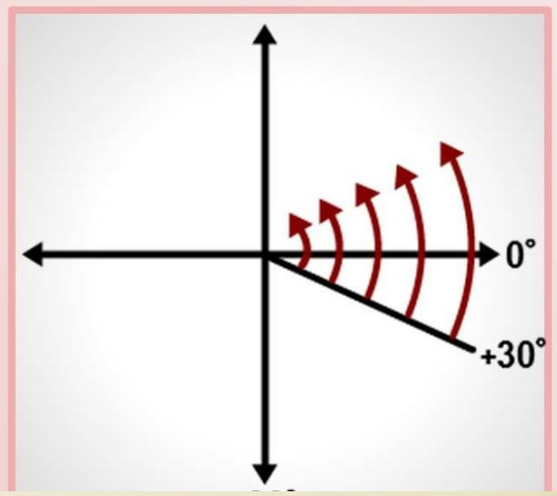


	Normal	Right	Left
II	RA LA	RA LA	RA LA
V_1	RA LA	RA LA	RA LA

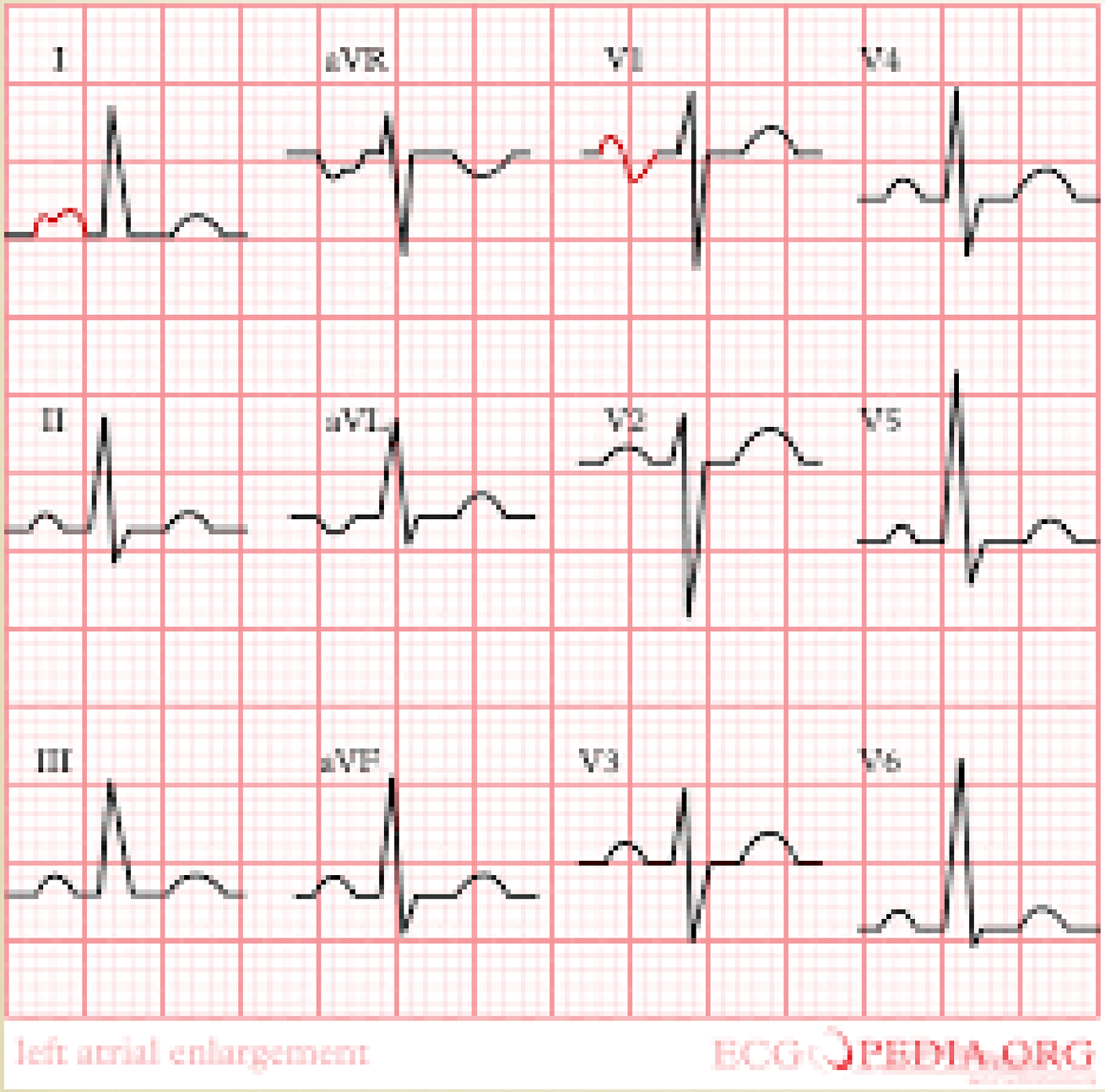
Chambers
LAE

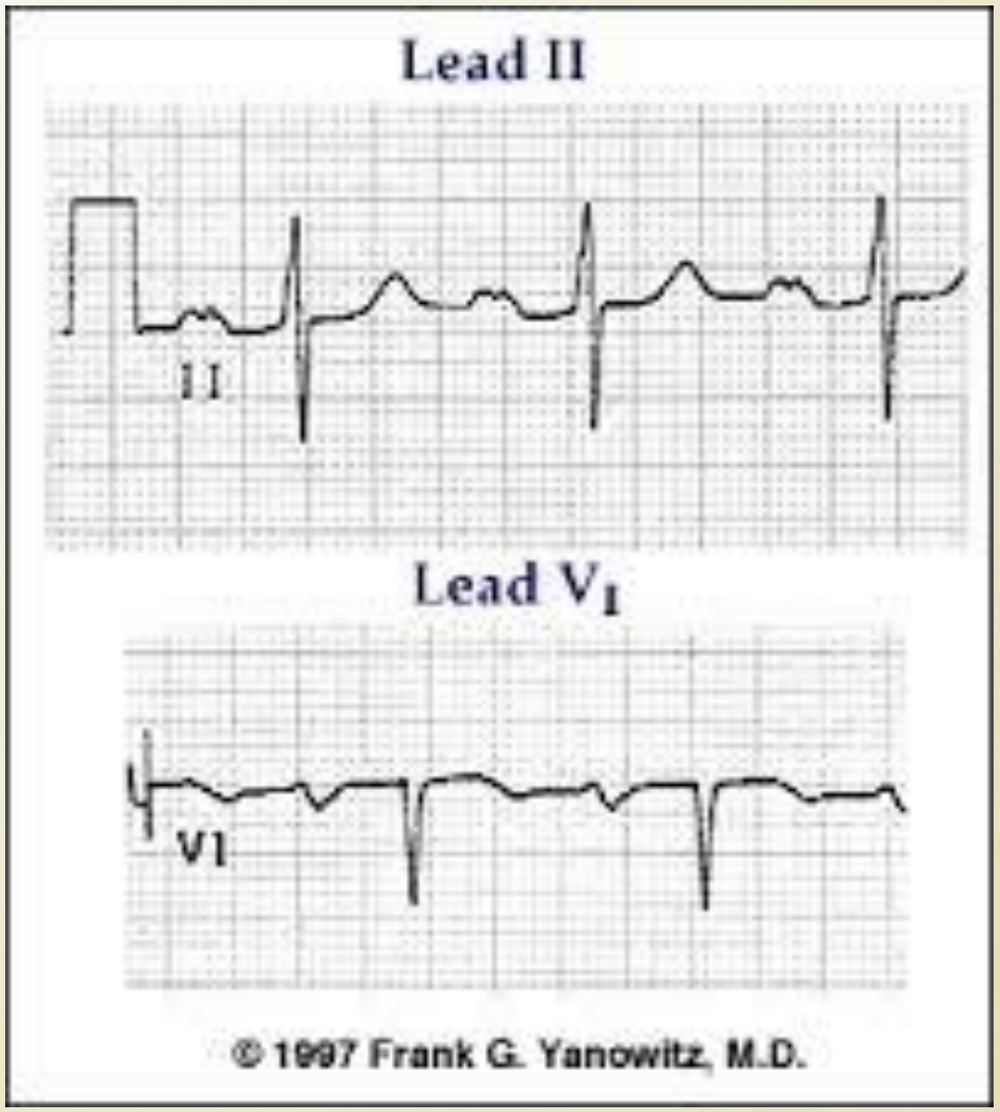


Chambers
LAE

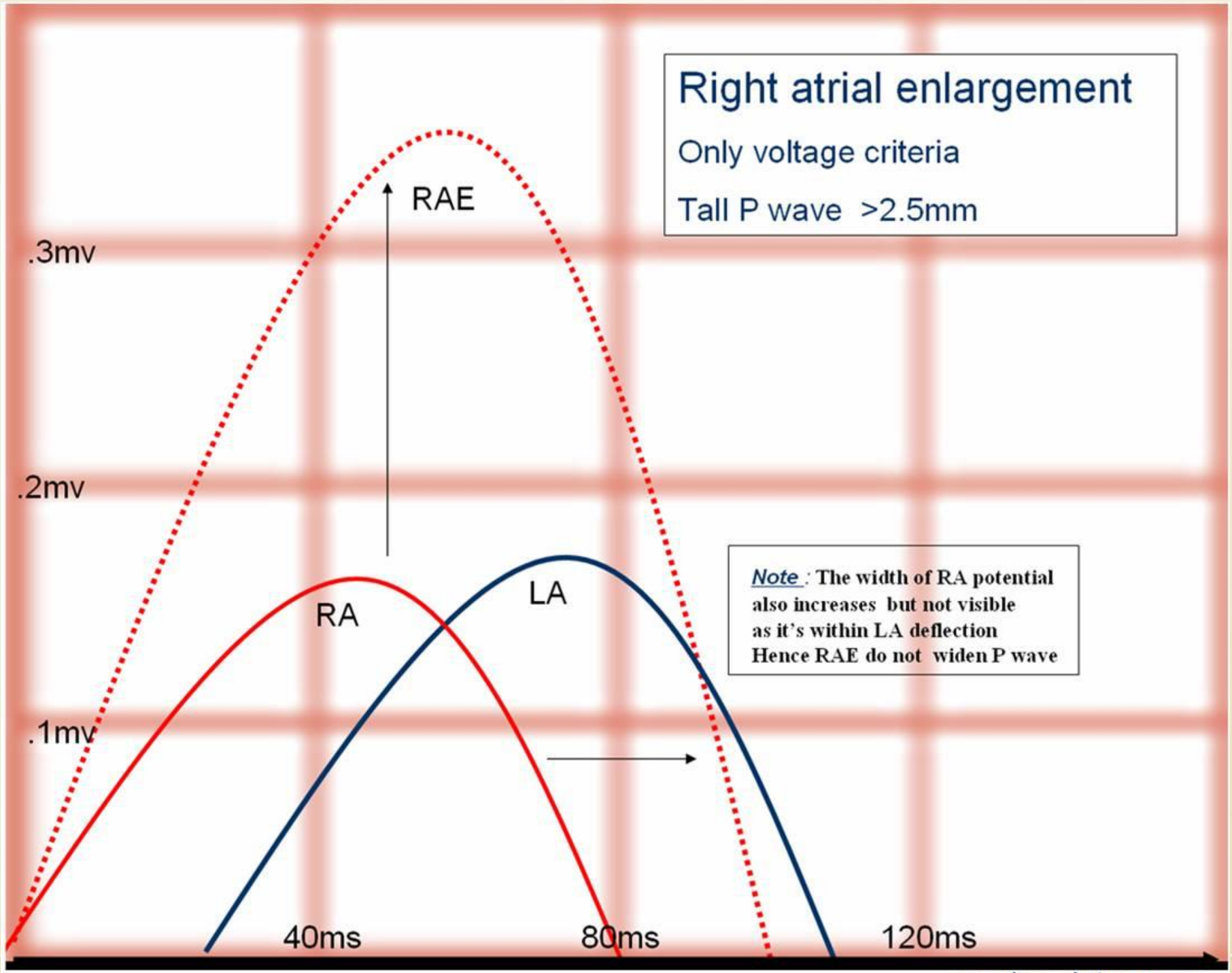
	Lead II	Lead V_1	P wave axis
Left Atrial Enlargement			

Chambers
LAE

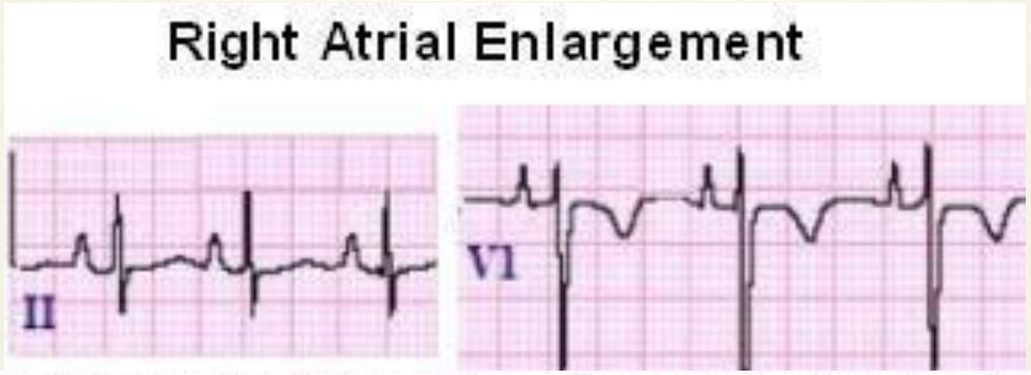


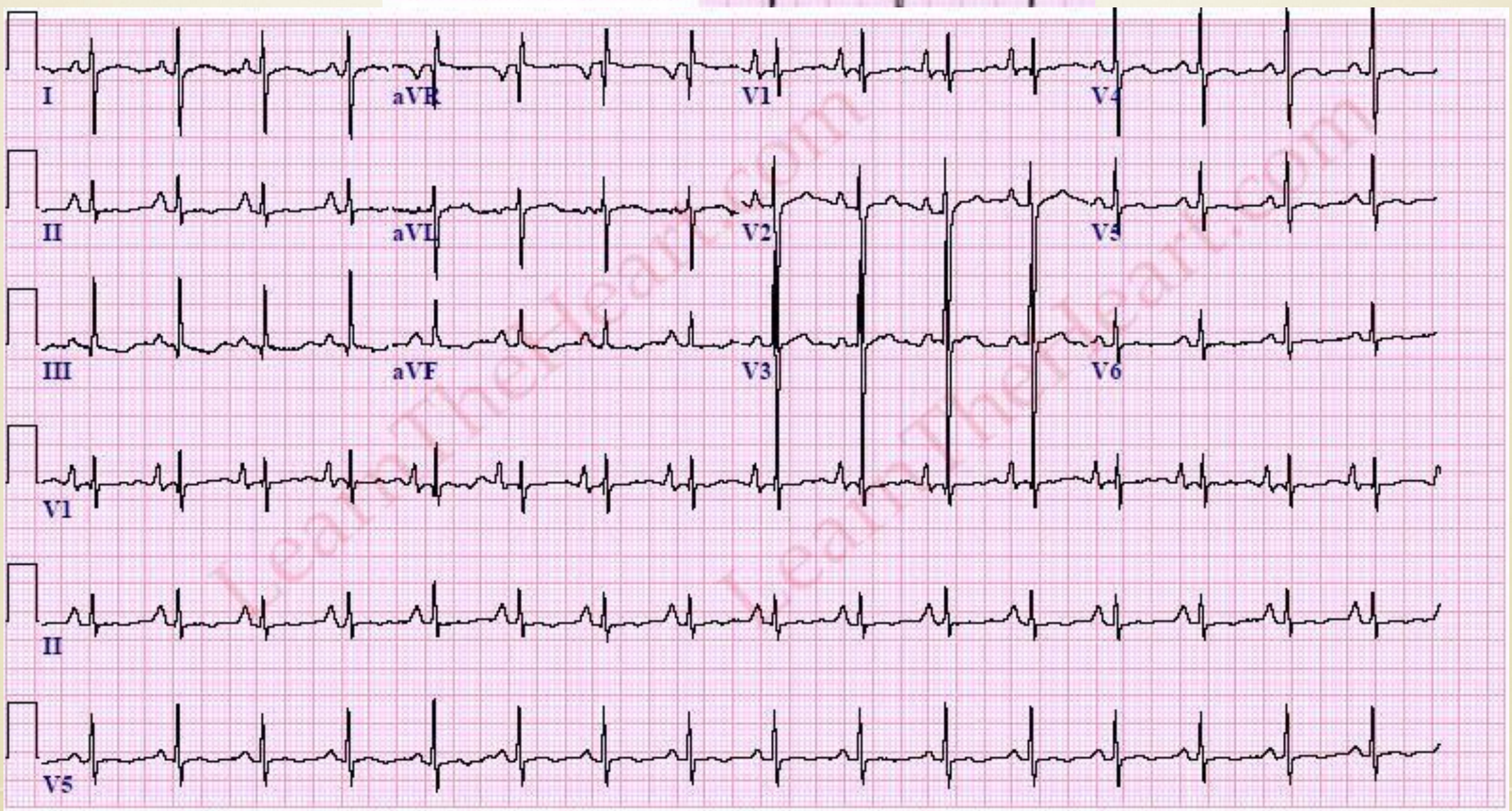


Chambers
RAE



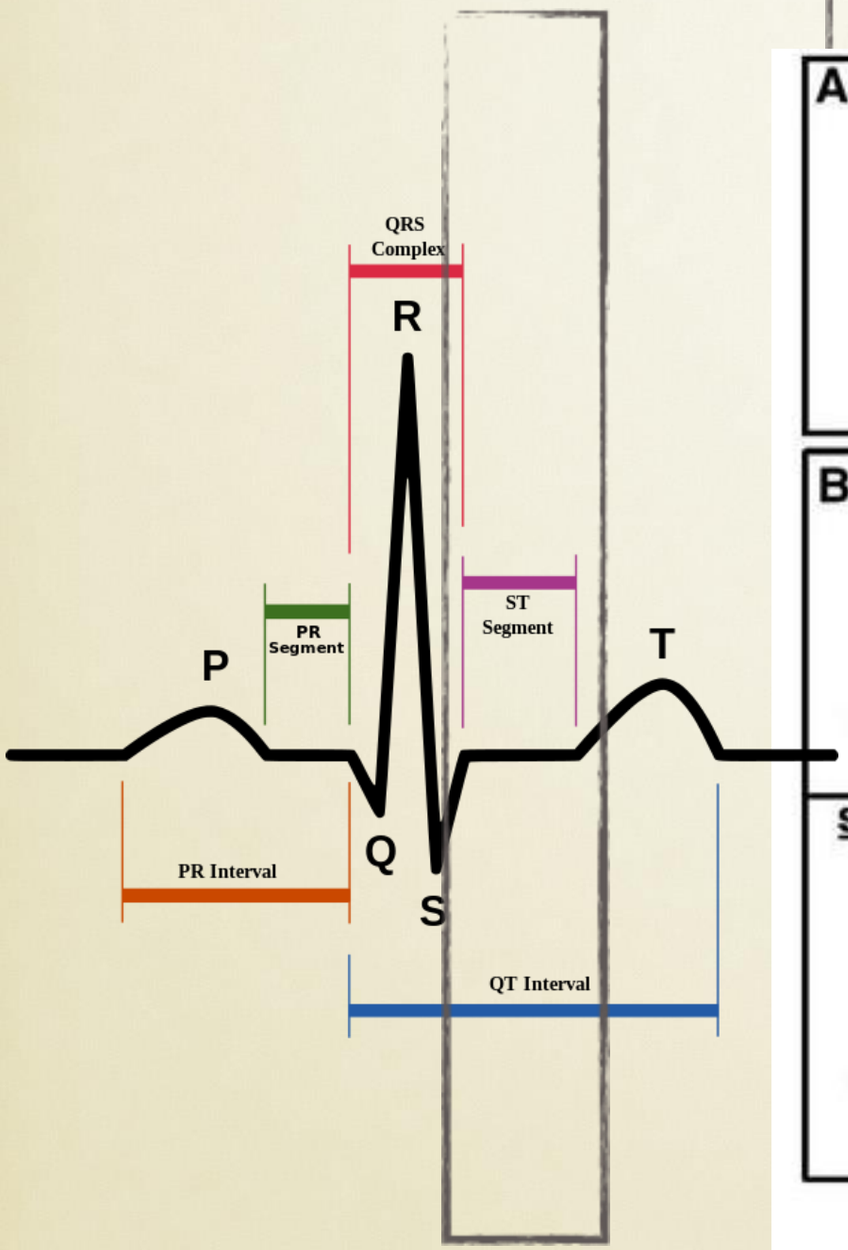
Chambers
RAE

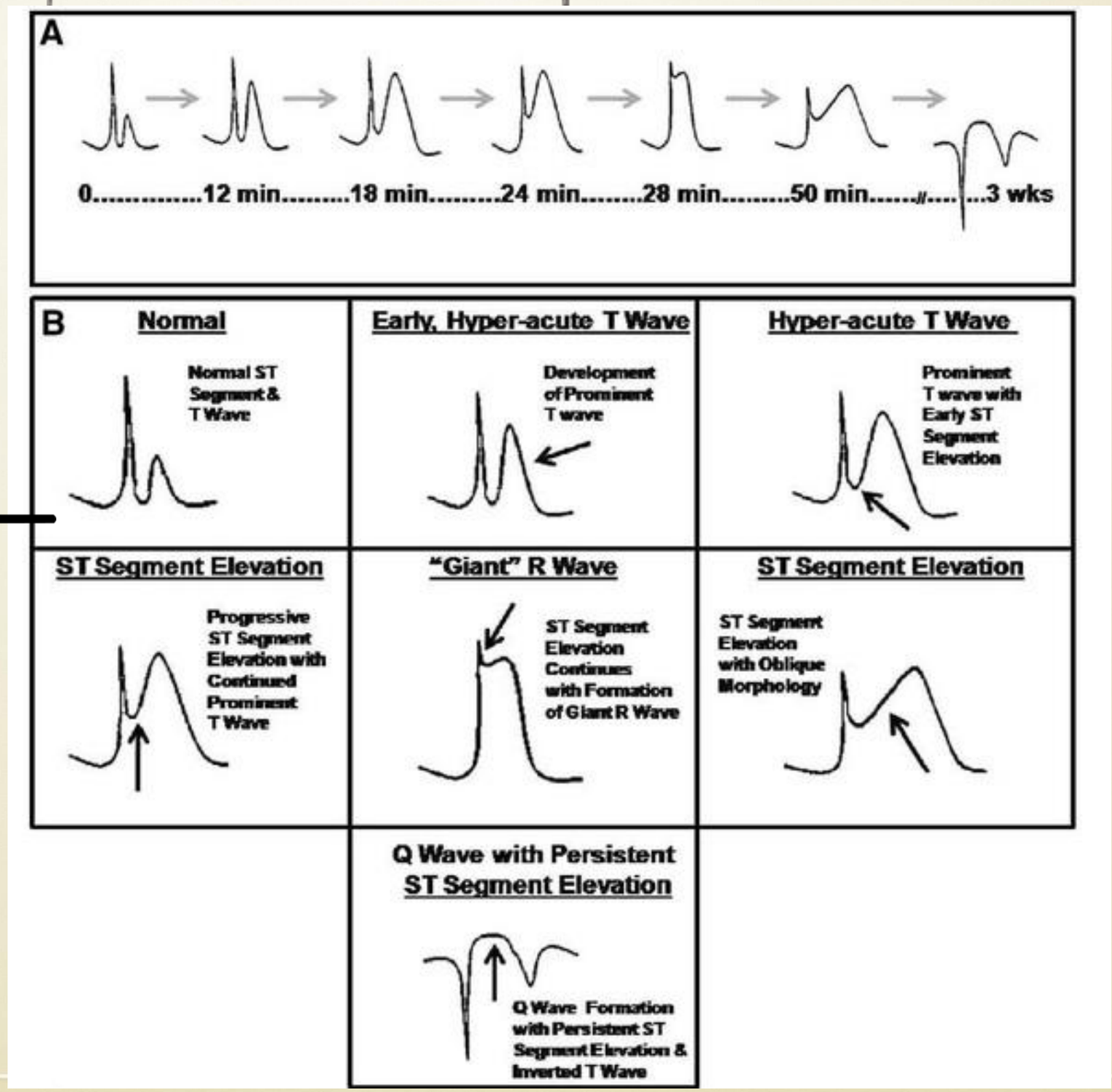




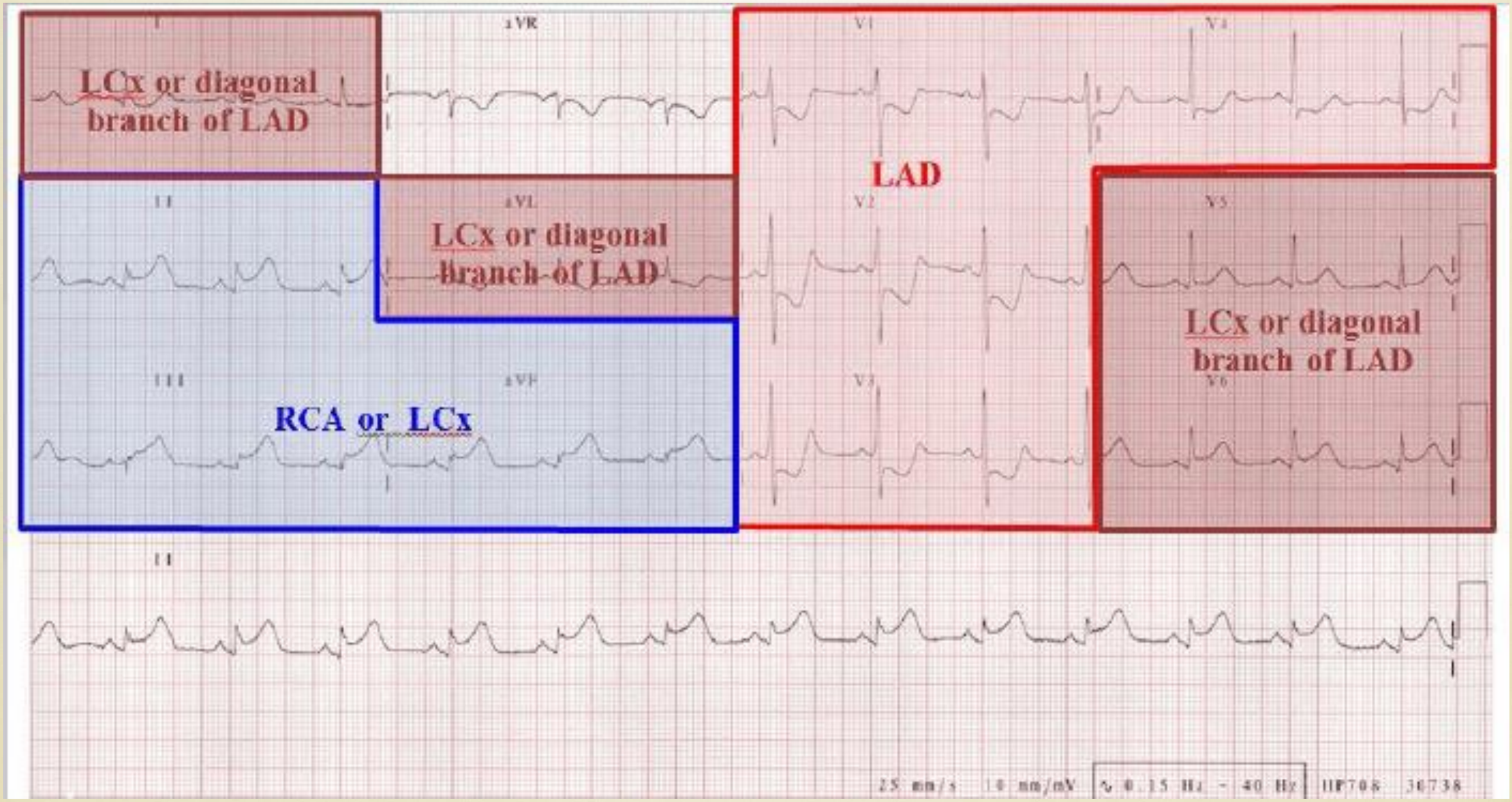
STT changes

STT change
STEMI

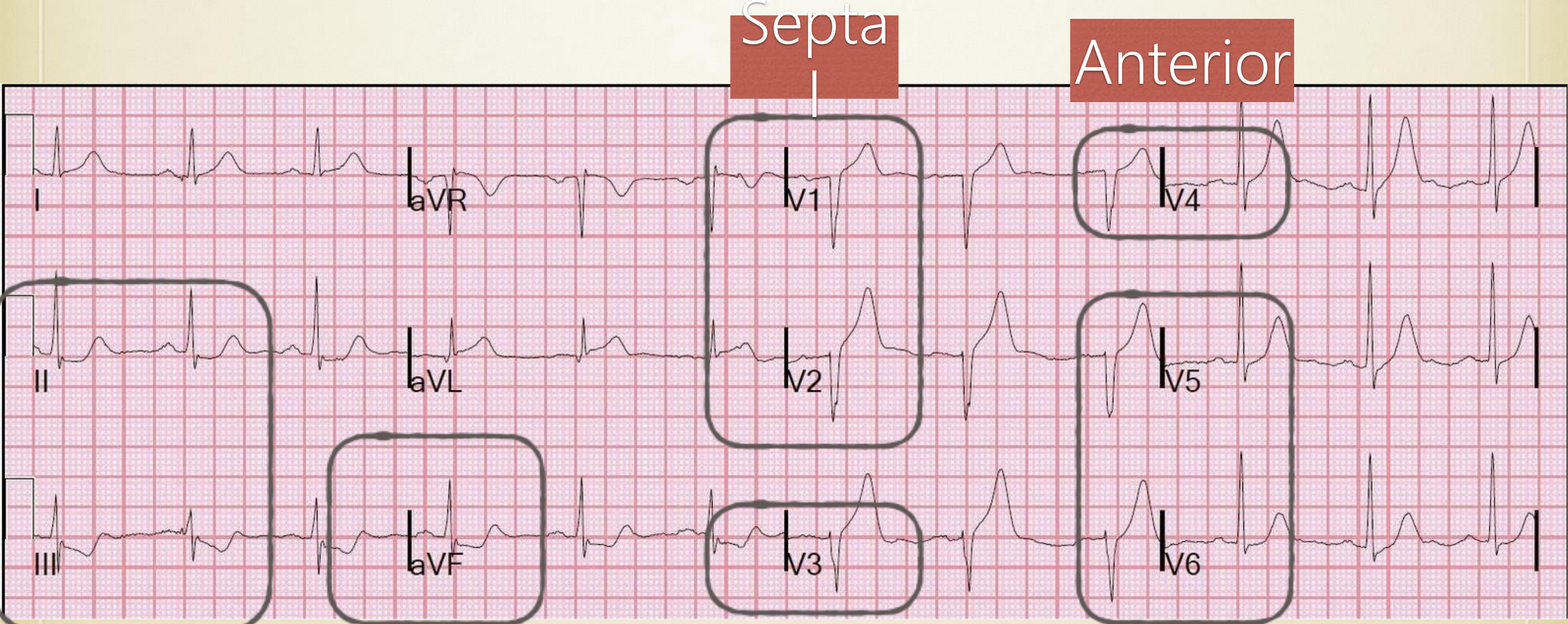




STT change
STEMI



STT change



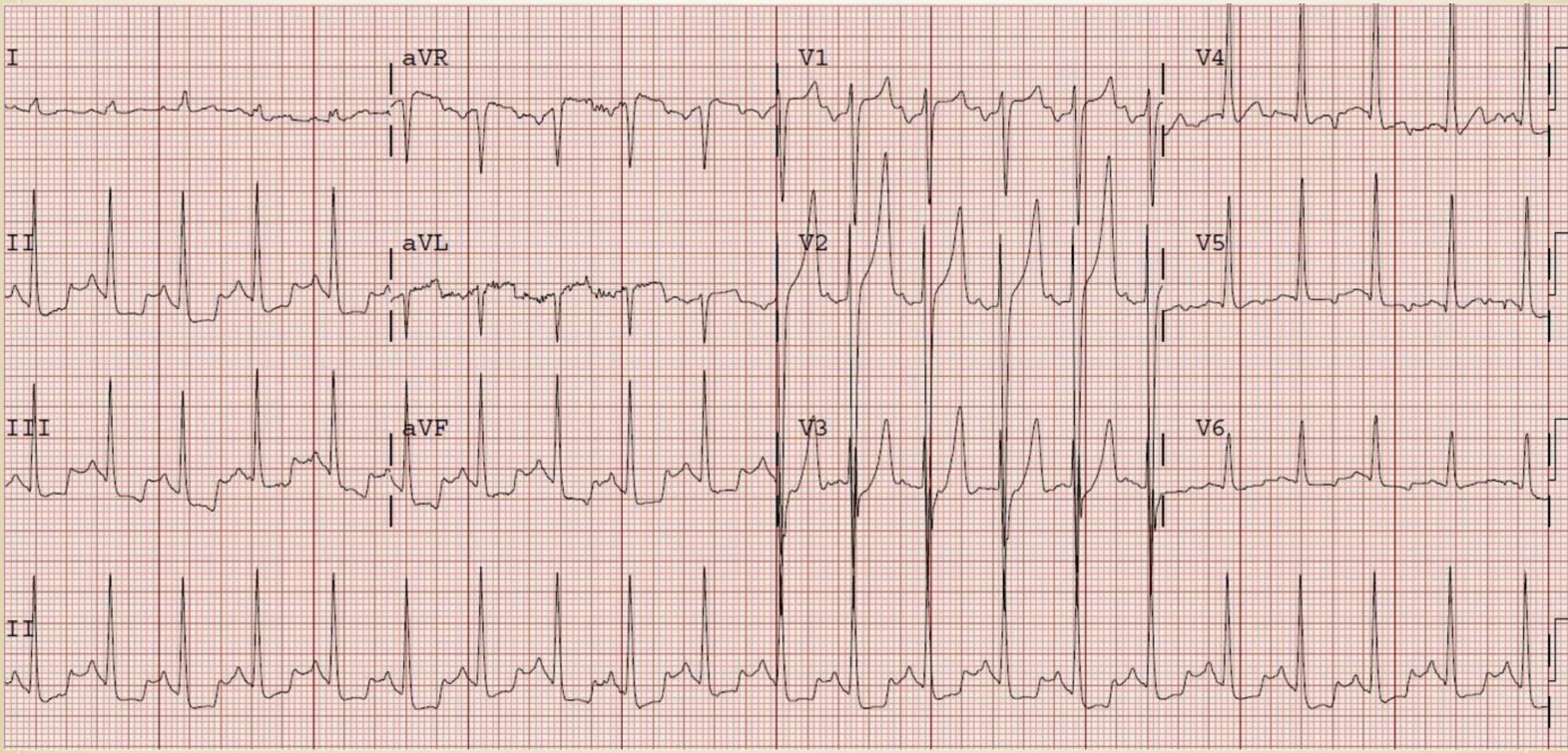
Septa
l

Anterior

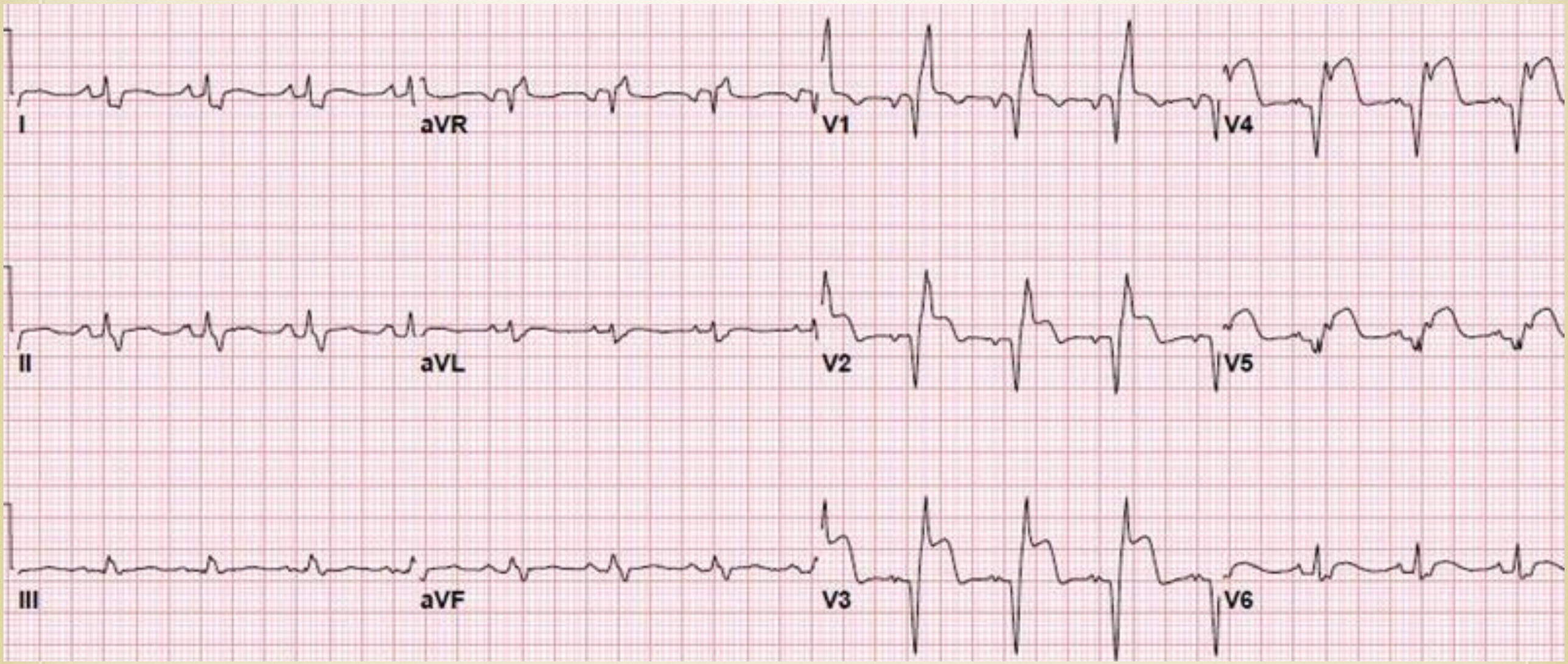
Inferior

Lateral

STT change
STEMI



STT change
STEMI



Others

Potassium

<2.5 mEq/L

Depressed ST Segment
Diphasic T Wave
Prominent U Wave

Normal

>6.0 mEq/L

Tall T Wave

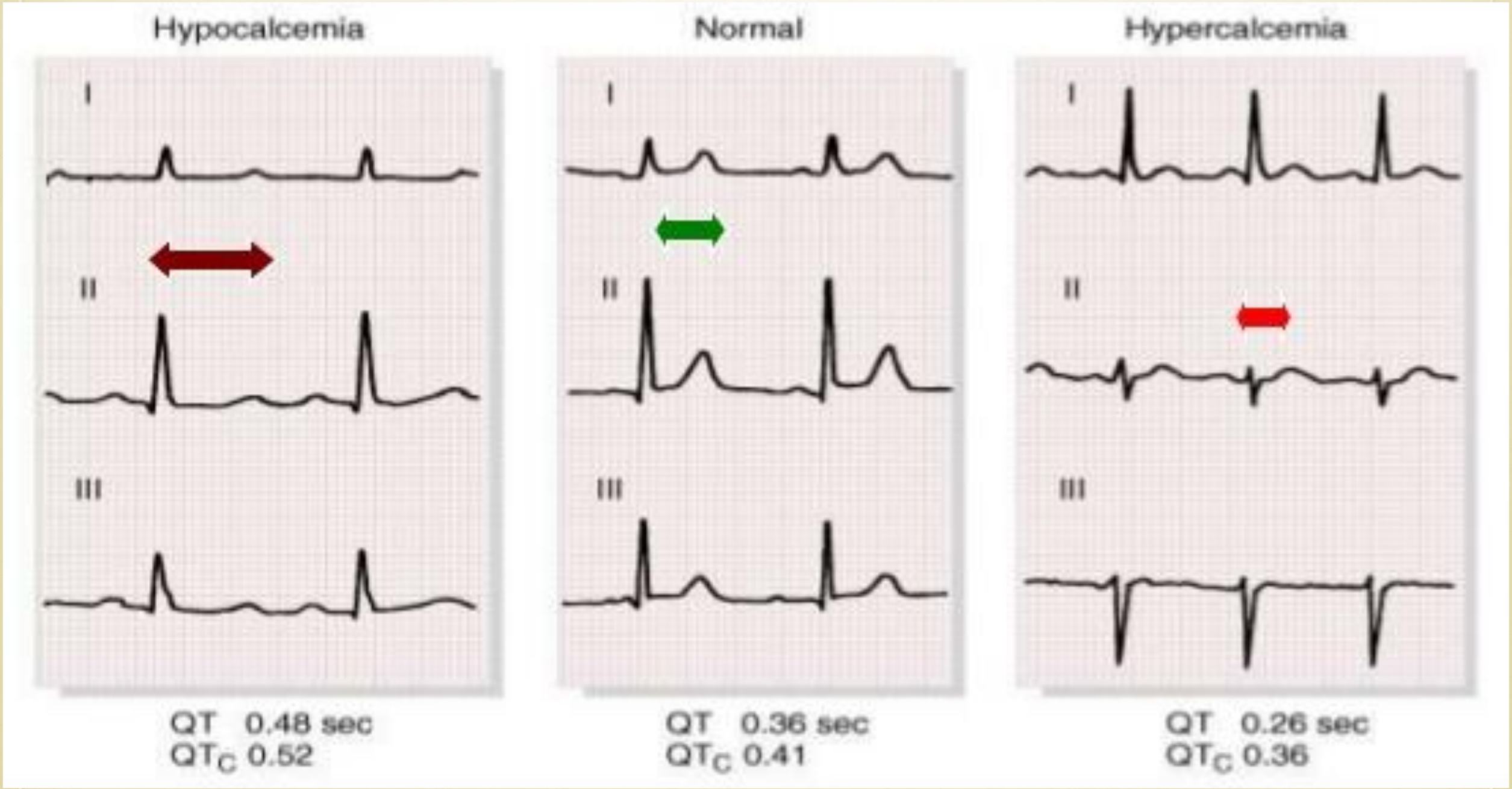
>7.5 mEq/L

Long PR Interval
Wide QRS Duration
Tall T Wave

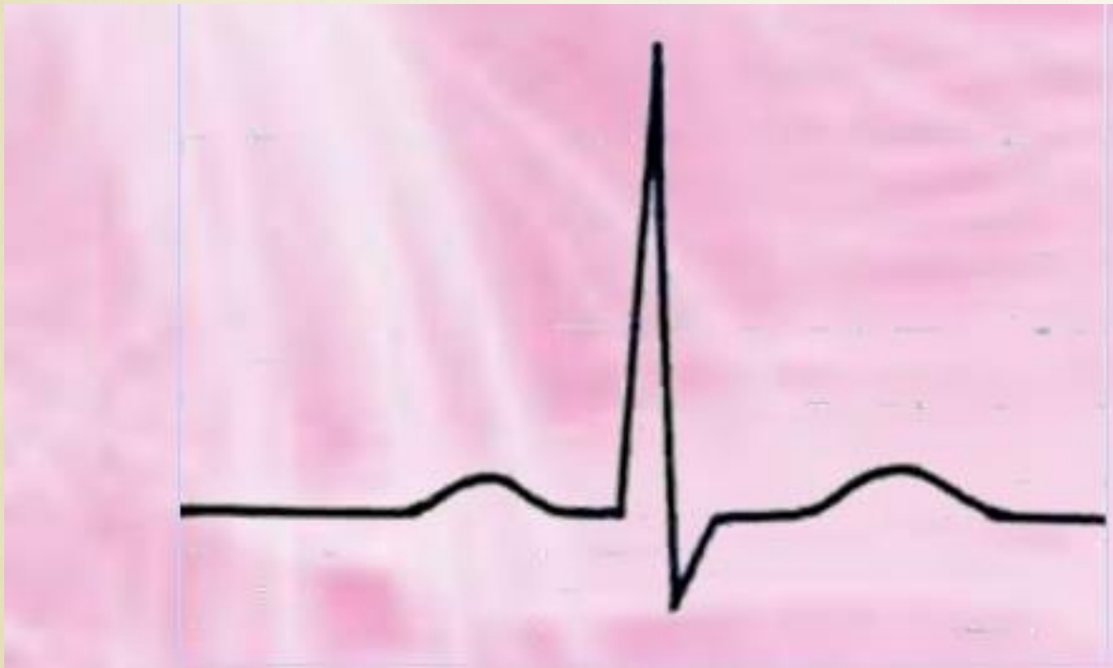
>9.0 mEq/L

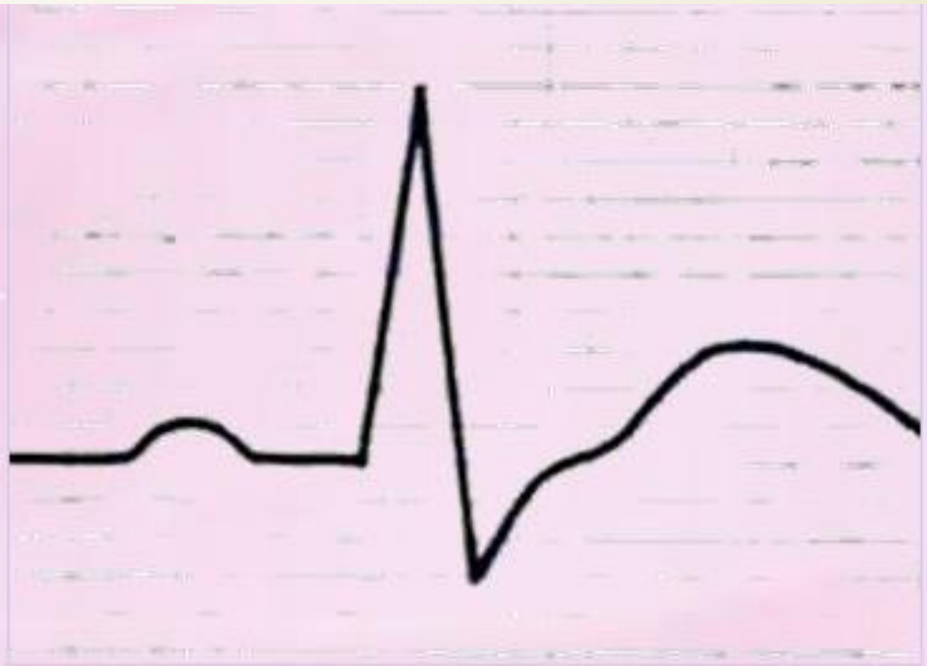
Absent P Wave
Sinusoidal Wave

Calcium


Hypocalcemia
Normal
Hypercalcemia
I
II
III
QT 0.48 sec
QTC 0.52
QT 0.36 sec
QTC 0.41
QT 0.26 sec
QTC 0.36

Magnesium





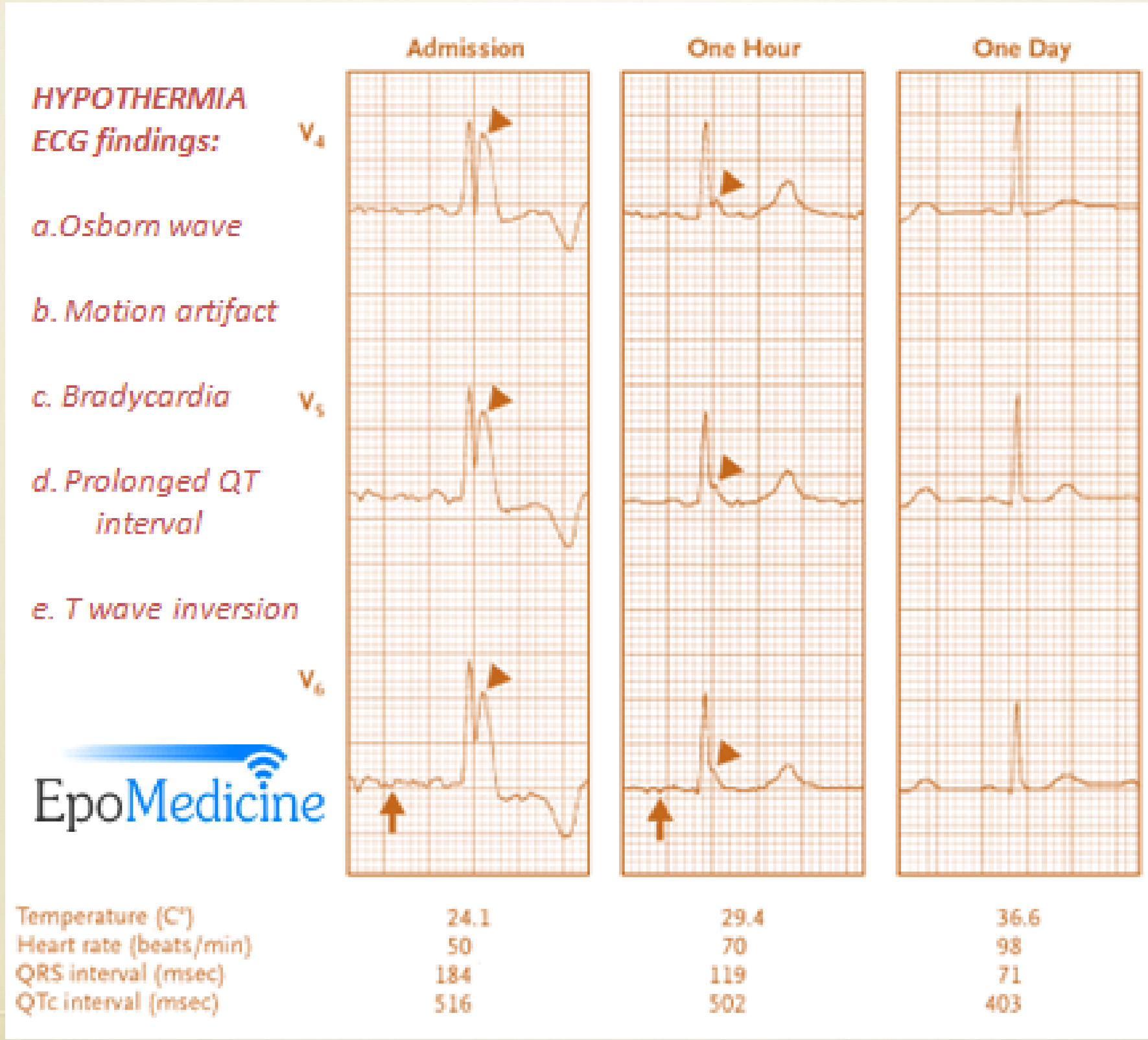
Serum Mg^{++} < 1.5mEq/L

- ***Lengthened QT***
- ***Broad & flattened T***
- ***often co-exist with hypokalemia***

Serum Mg^{++} > 2.5mEq/L

- ***Prolonged PR***
- ***Lengthened QT***
- ***QRS >*** *0.12sec*

Hypothermia



感謝聆聽