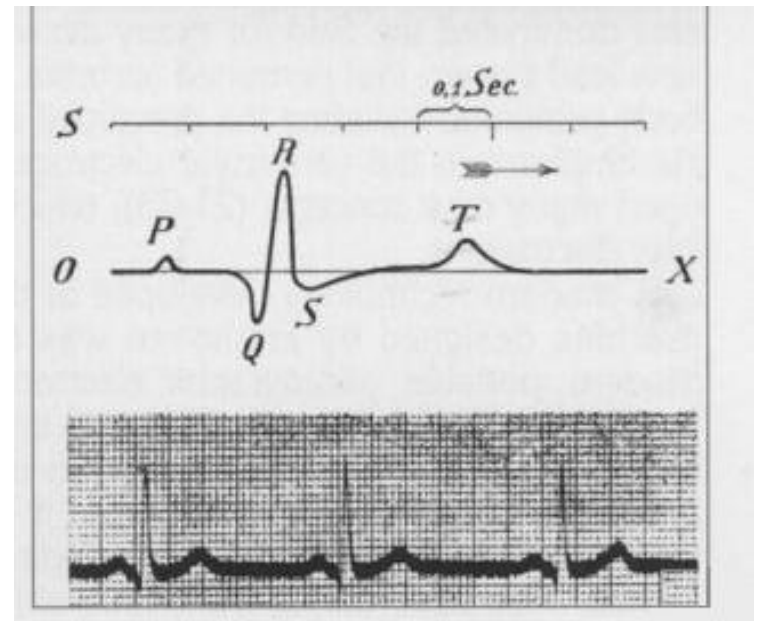
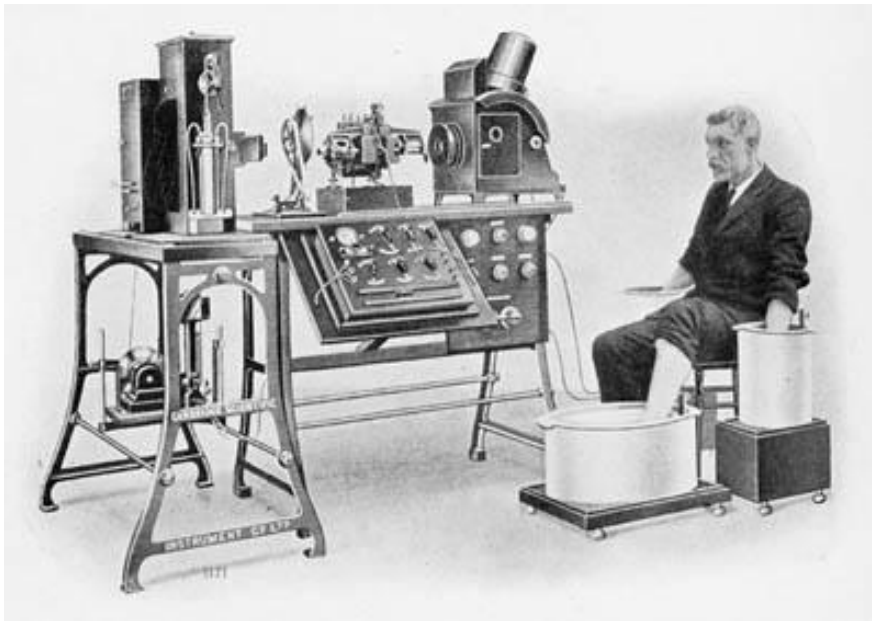


ECG Basics

한림대학교성심병원
한 상 진

심전도 (EKG) 란?

- 심박동과 관련된 전위를 신체표면에서 도형으로 기록하는 것



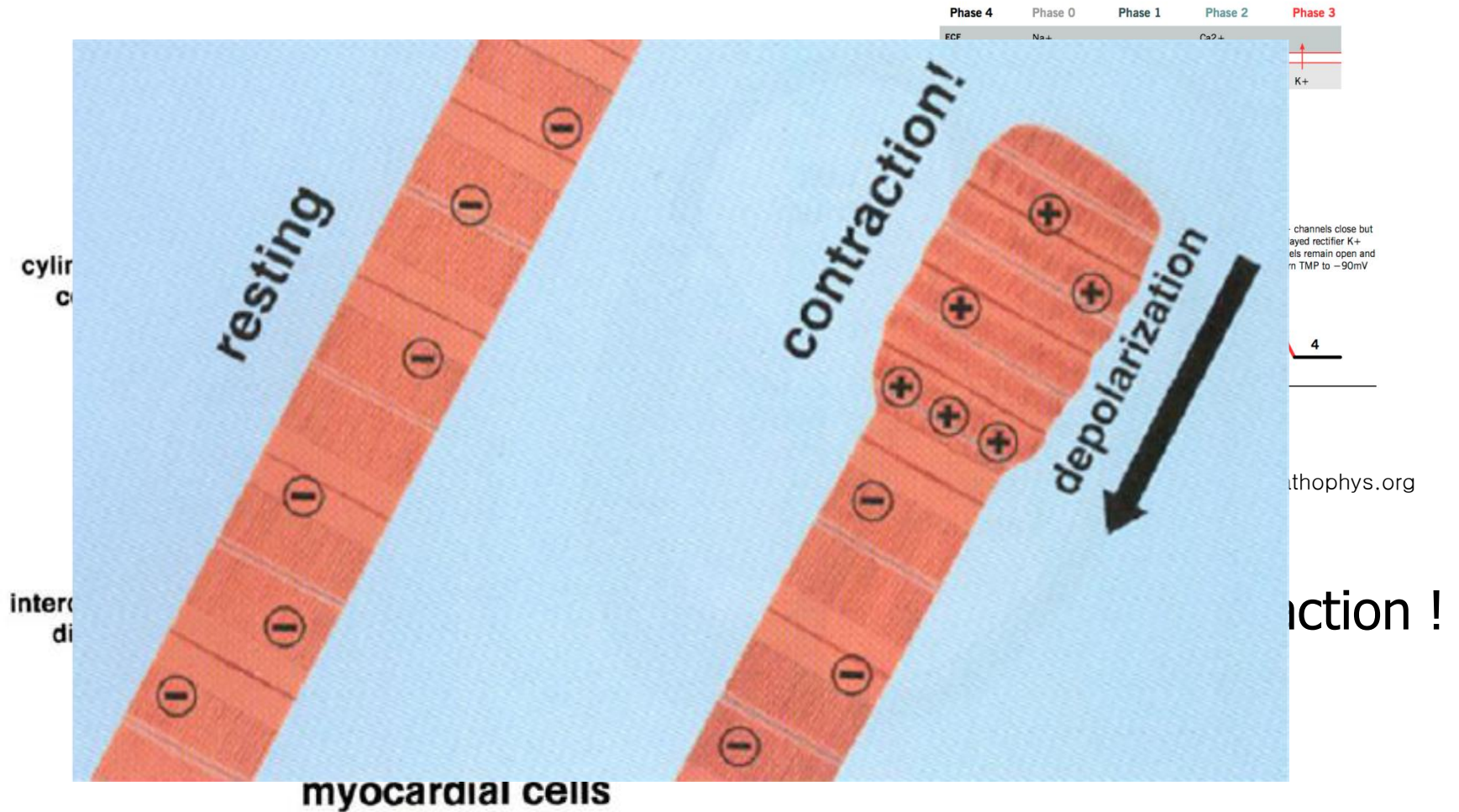
JACC, 2000;36:1737-45

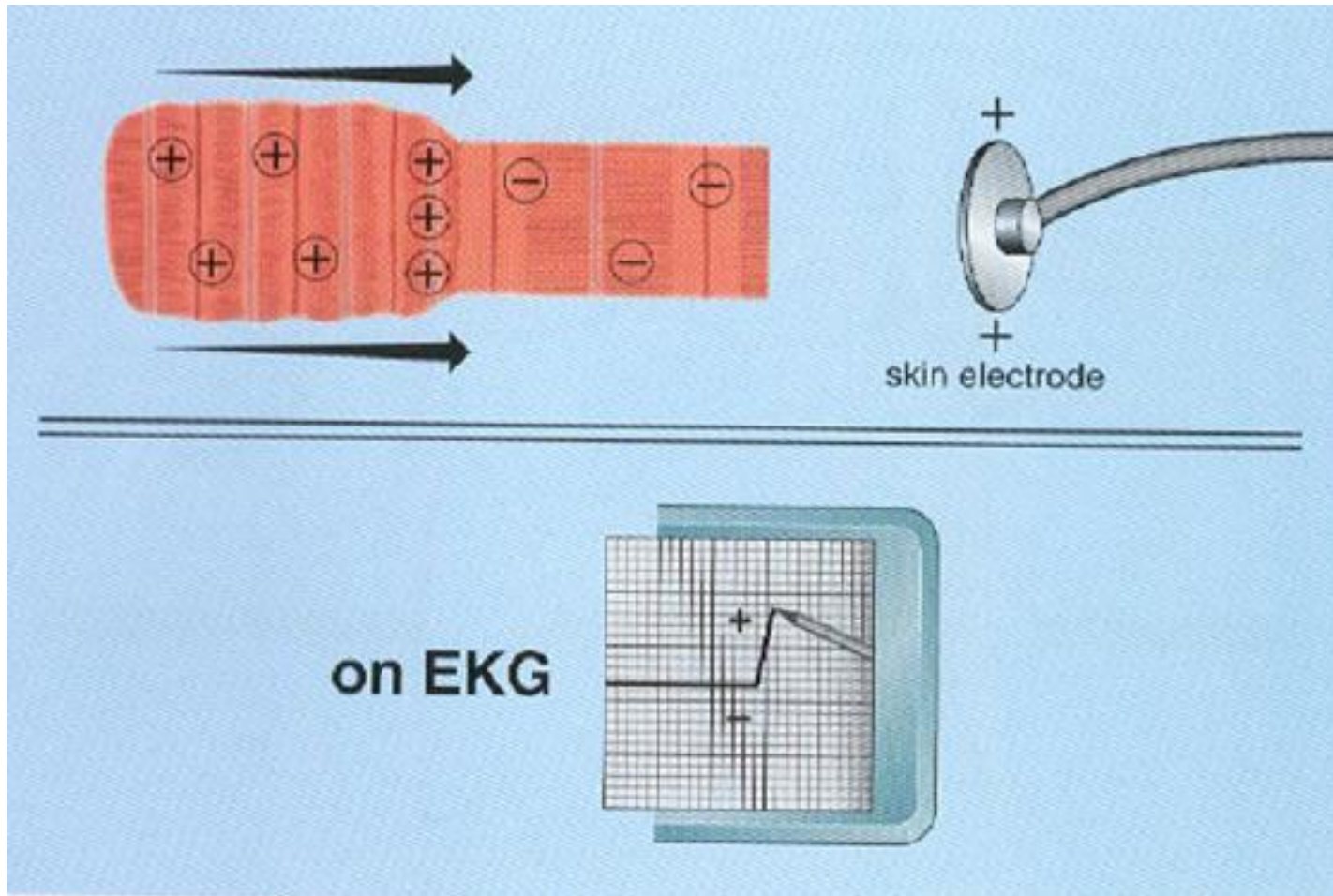
1903, Einthoven이 처음으로 표면심전도를 측정

Electrical activity

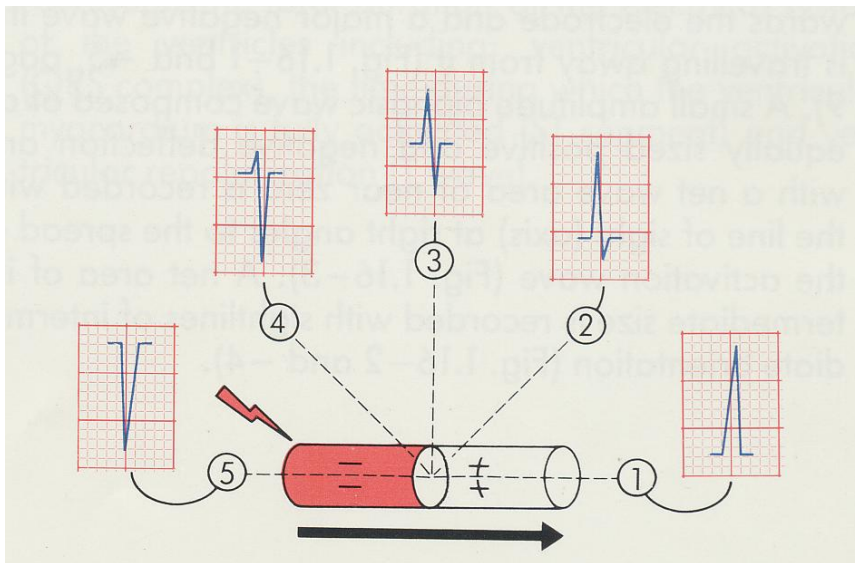
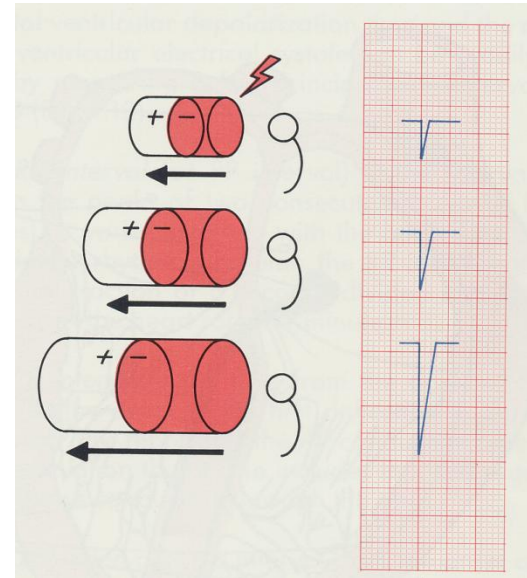
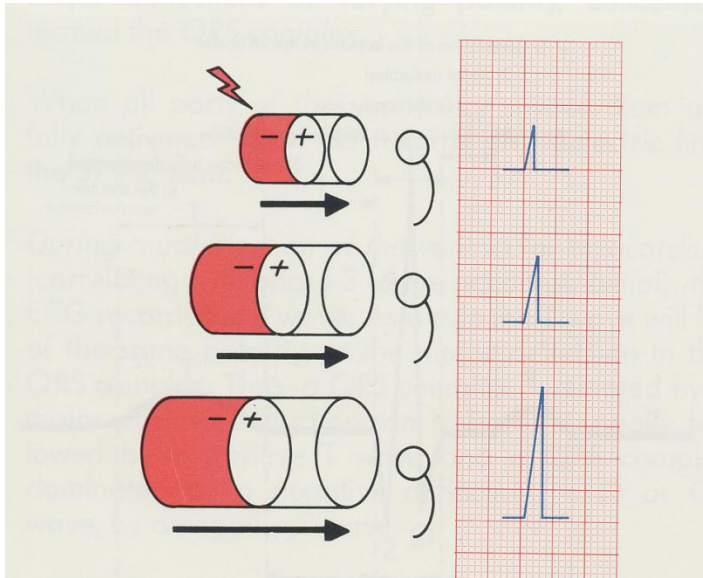
Action potential of cardiac muscles

Grigoriy Ikonnikov and Eric Wong



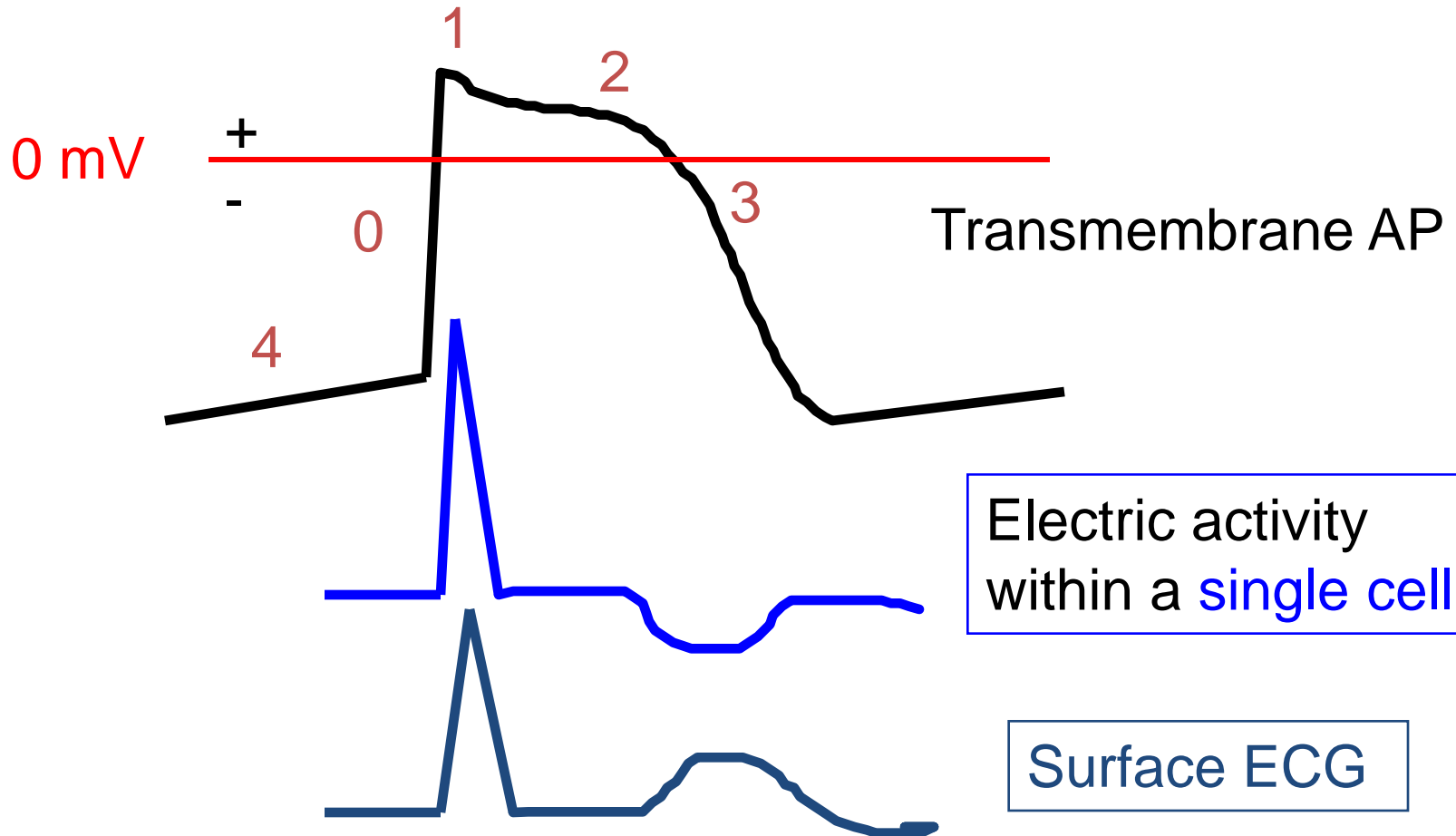


표면 심전도는 벡터의 총합
→ 크기와 방향이 있다.

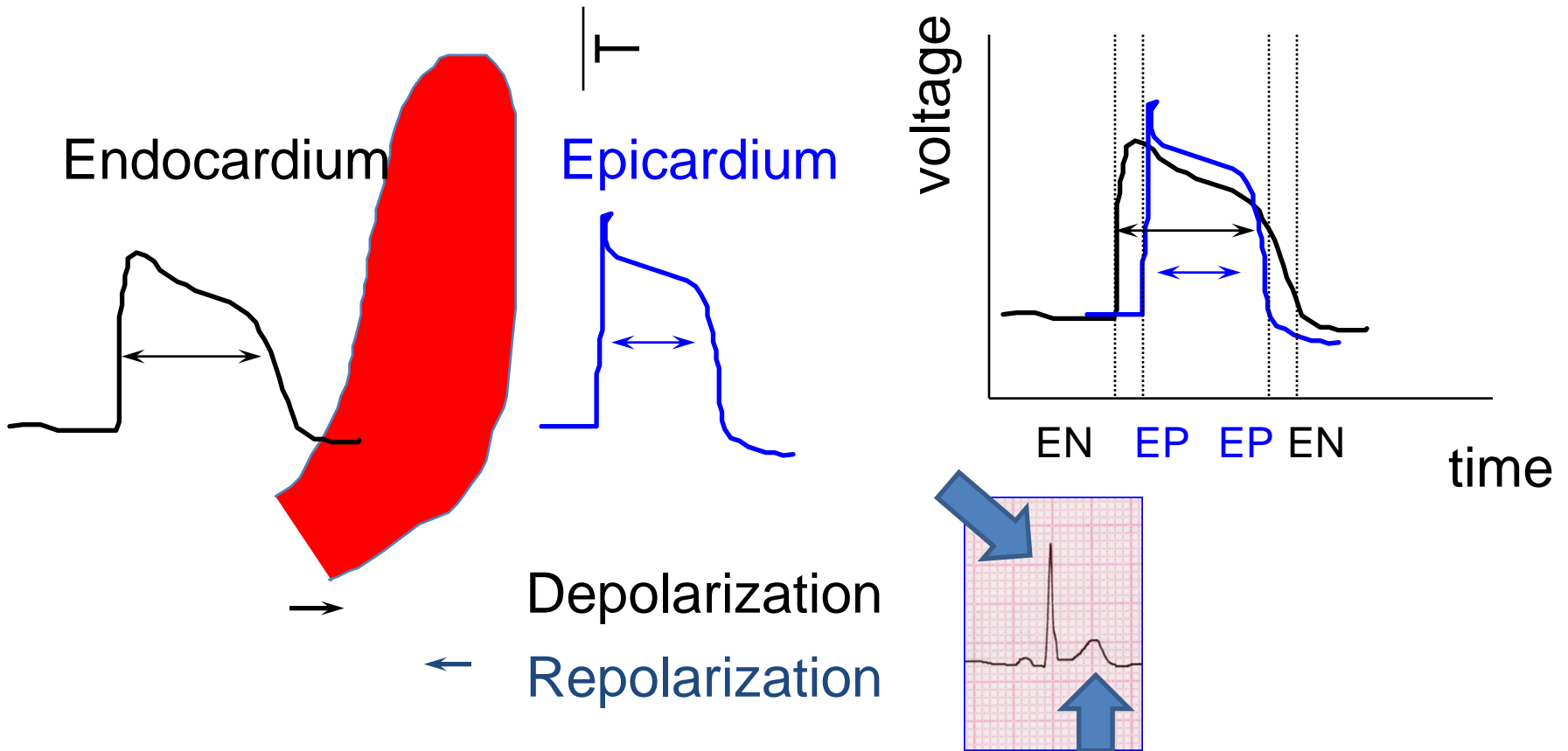


③은 전류의 방향이 90'인 지점이며, 상하의 크기가 같다(biphasic)

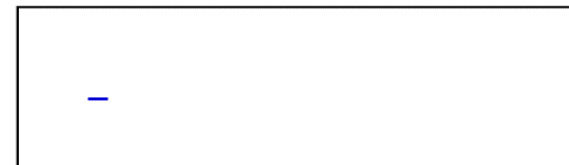
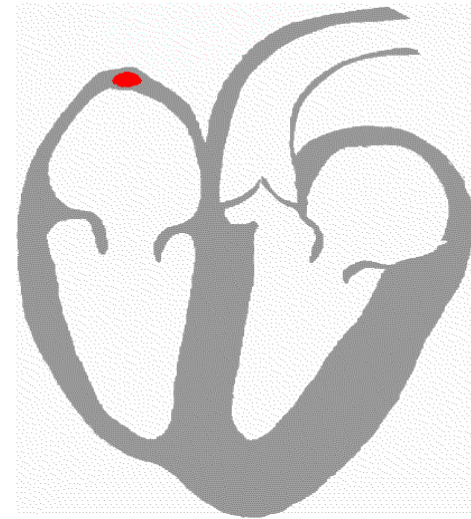
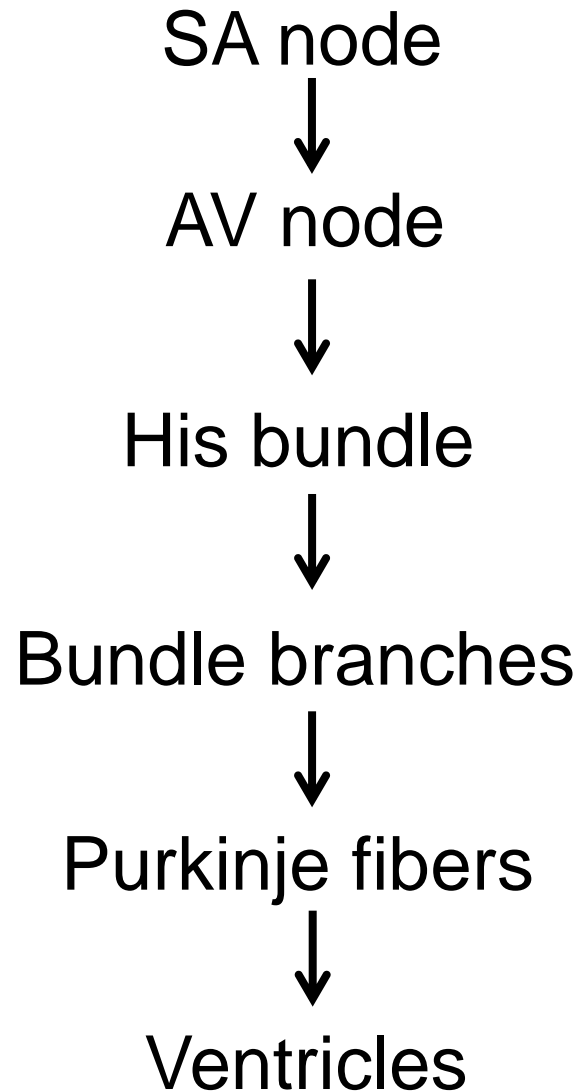
Transmembrane action potential and surface ECG



Same vector of de/re-polarization (in surface ECG)



Impulse Conduction & the ECG



<http://en.wikipedia.org>

표준 12유도 심전도

- 심장은 3차원의 구조물로 정확한 벡터를 알기 위해서는 3차원적인 측정이 필요하게 되며, 이를 위해 표준유도와 사지유도, 흉부유도의 12 유도 심전도가 필요하다

• 사지 유도 (Limb lead)

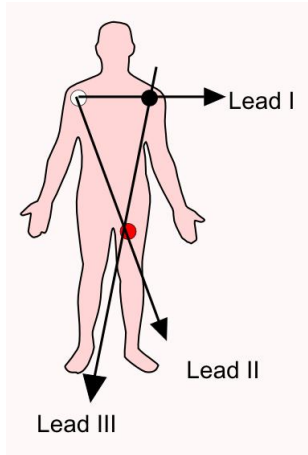
– 양극유도 (Bipolar lead) : I, II, III

Standard lead

유도 I : 오른손 (-) 과 왼손

유도 II : 오른손 (-) 과 왼발

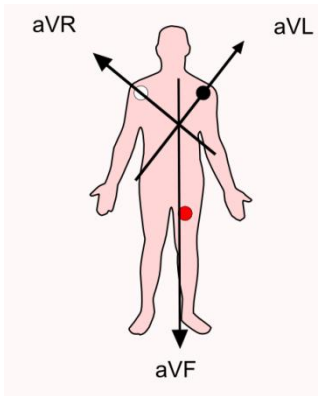
유도 III : 왼손 (-) 과 왼발의 전위차를 기록



– 단극유도 (Unipolar lead) : aV_L , aV_F , aV_R

Extremity lead

aV_L 은 왼손, aV_F 은 왼발, aV_R 은 오른손의 전위를 증폭 (+50%)하여 기록

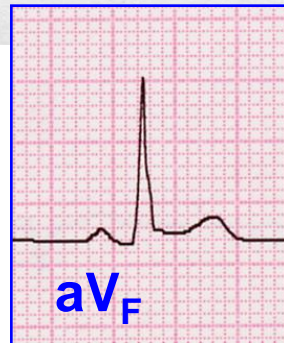
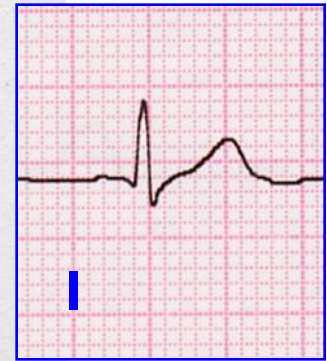
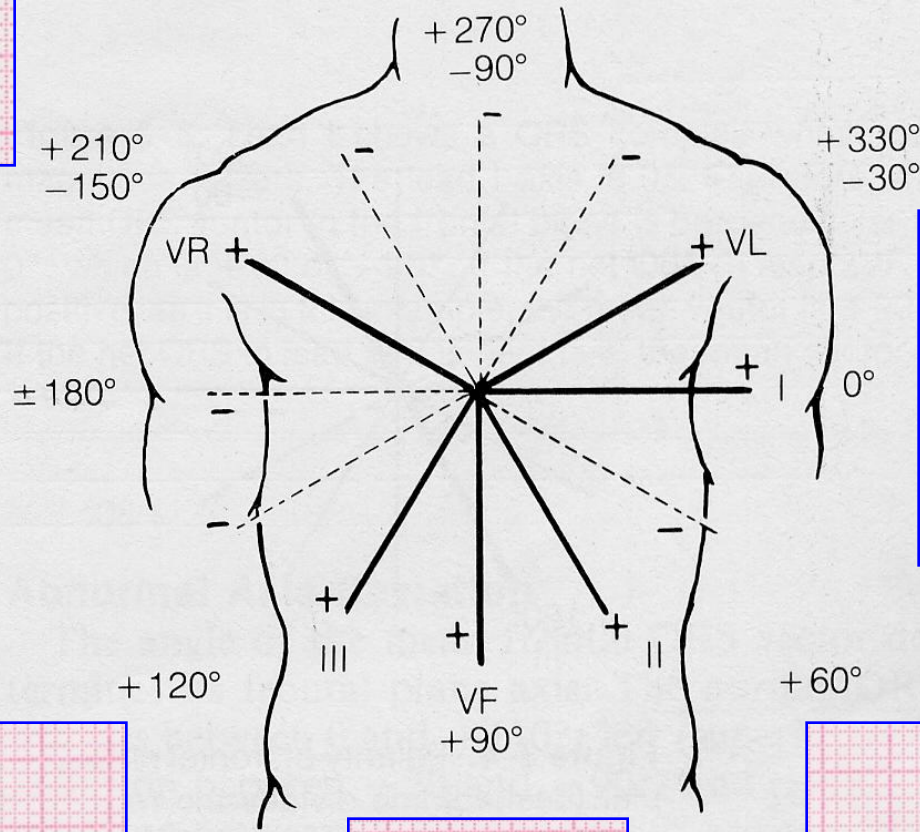
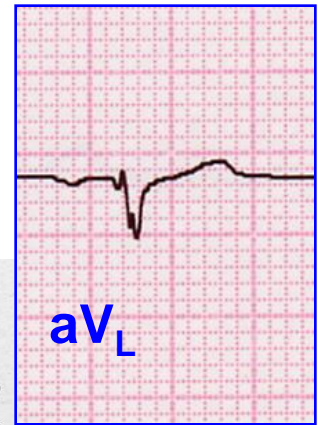
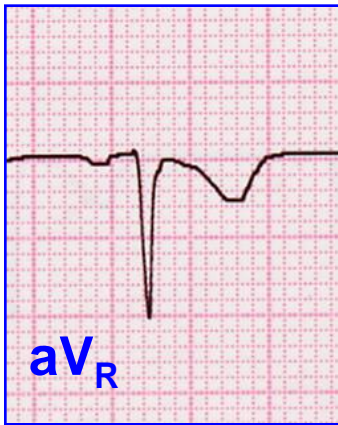


• 흉부유도 (Precordial lead) : V_{1-6}

다음 중 연관이 없는 유도는 ?

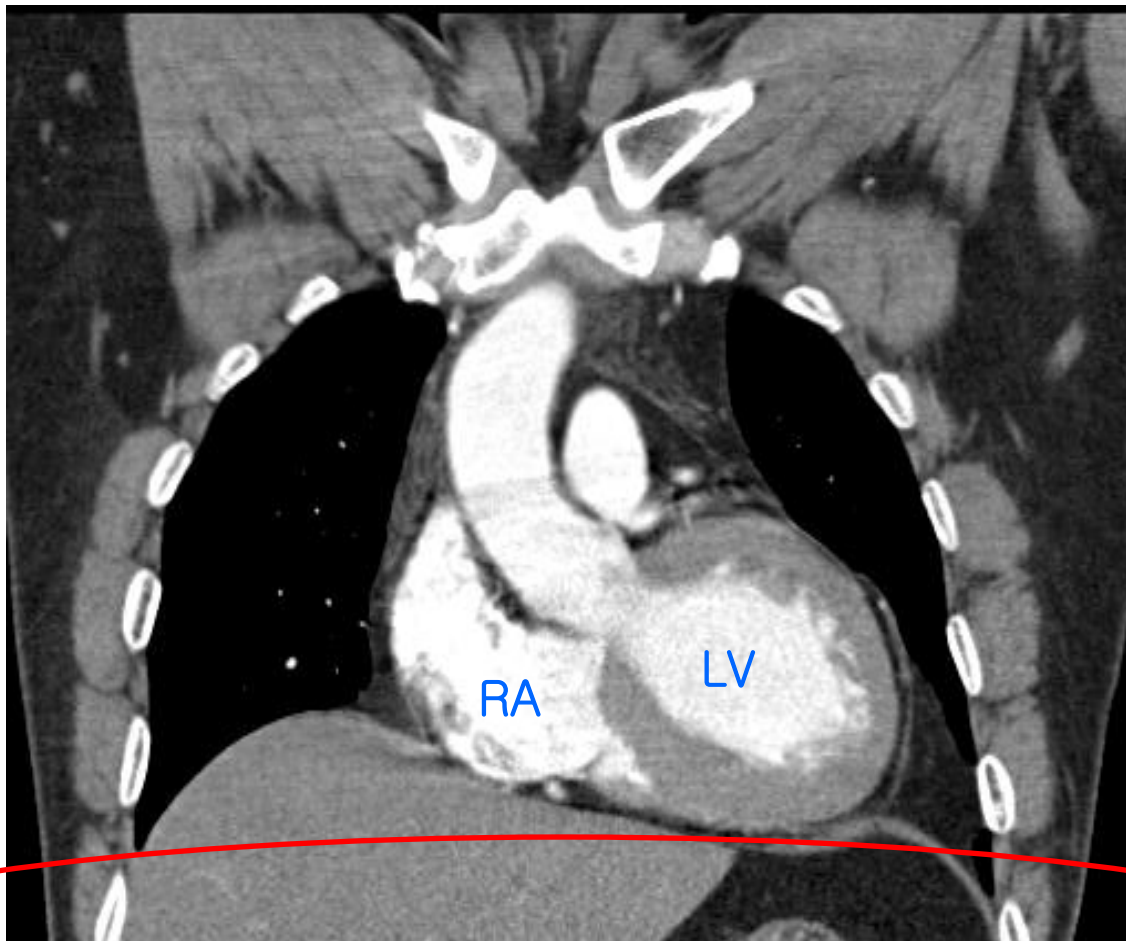
- 1) I 2) aVL 3) aVR 4) V6

사지유도



사지 유도와 실제 심장과의 관계

aV_R



aV_L

I

lateral leads

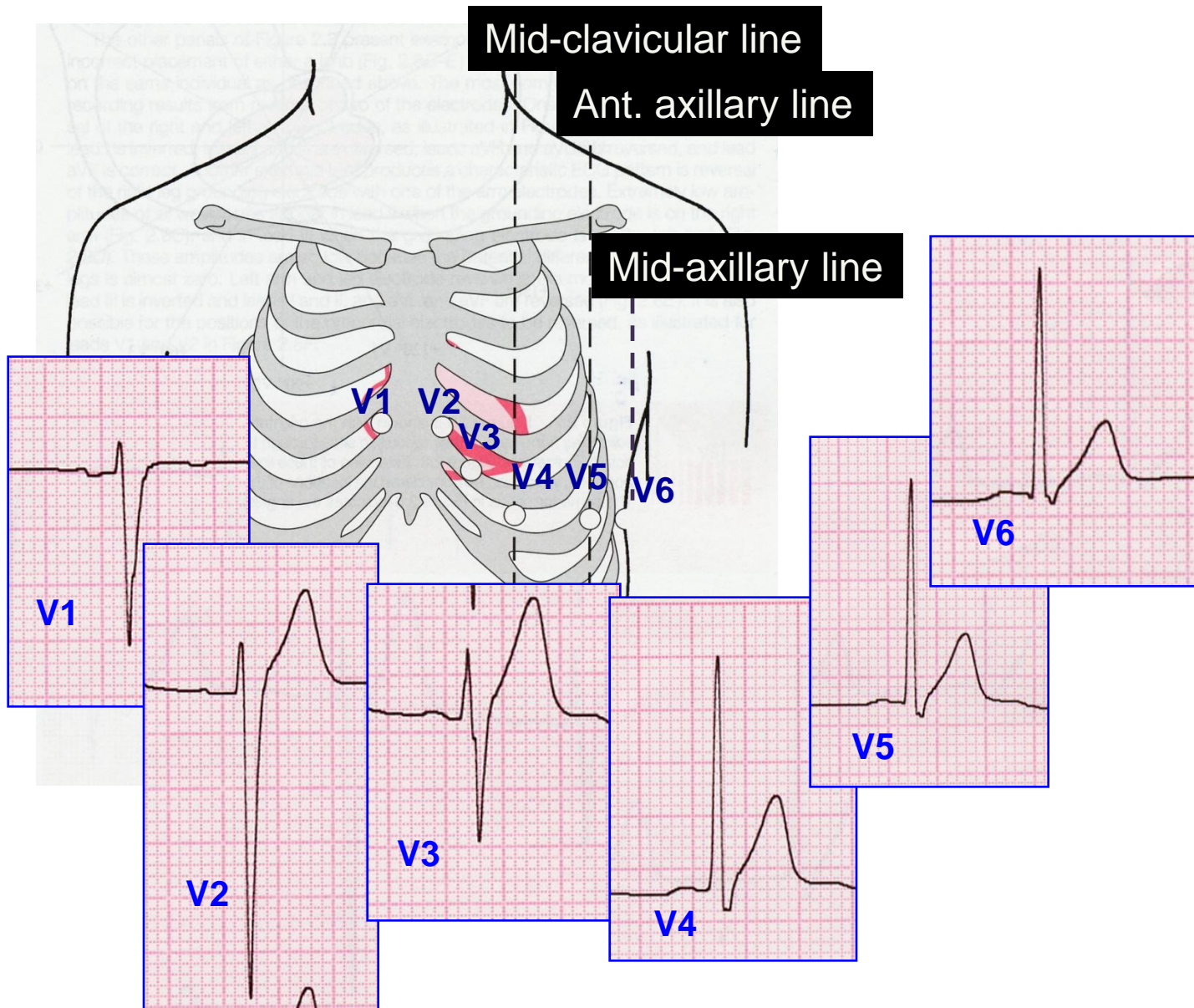
III

aV_F

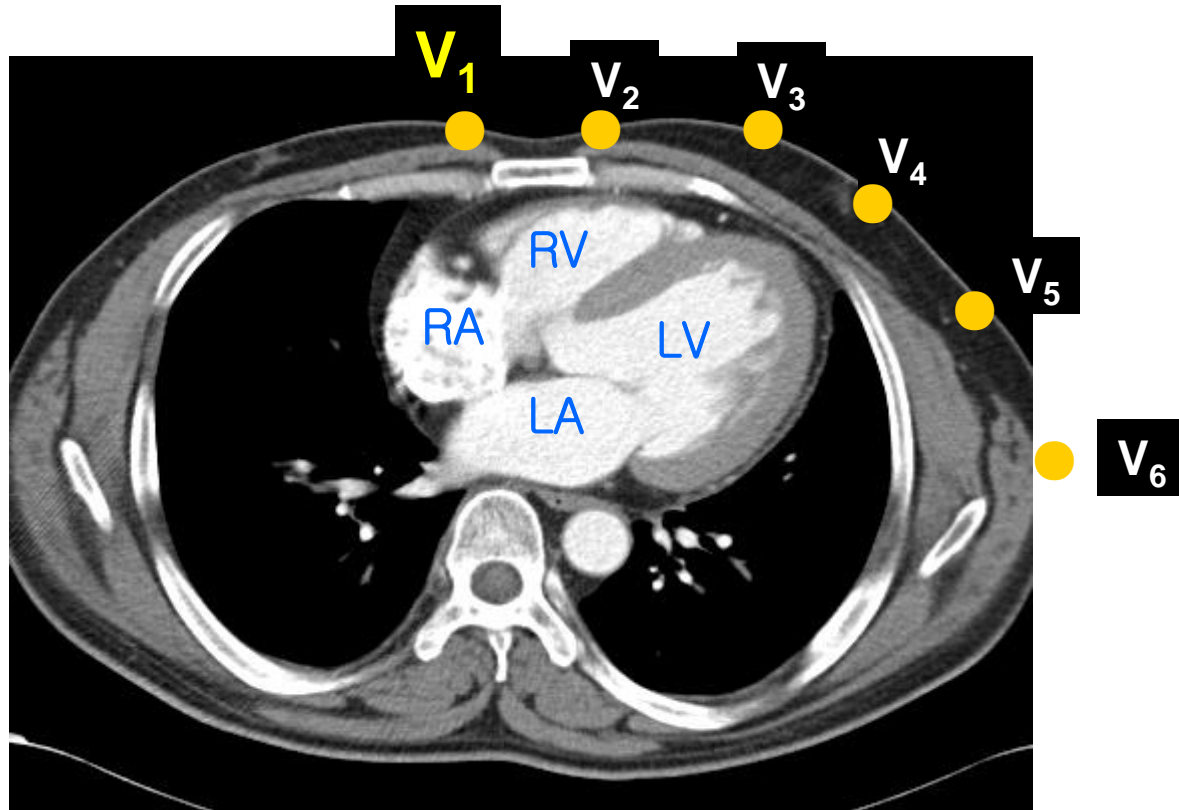
II

Inferior leads

흉부유도

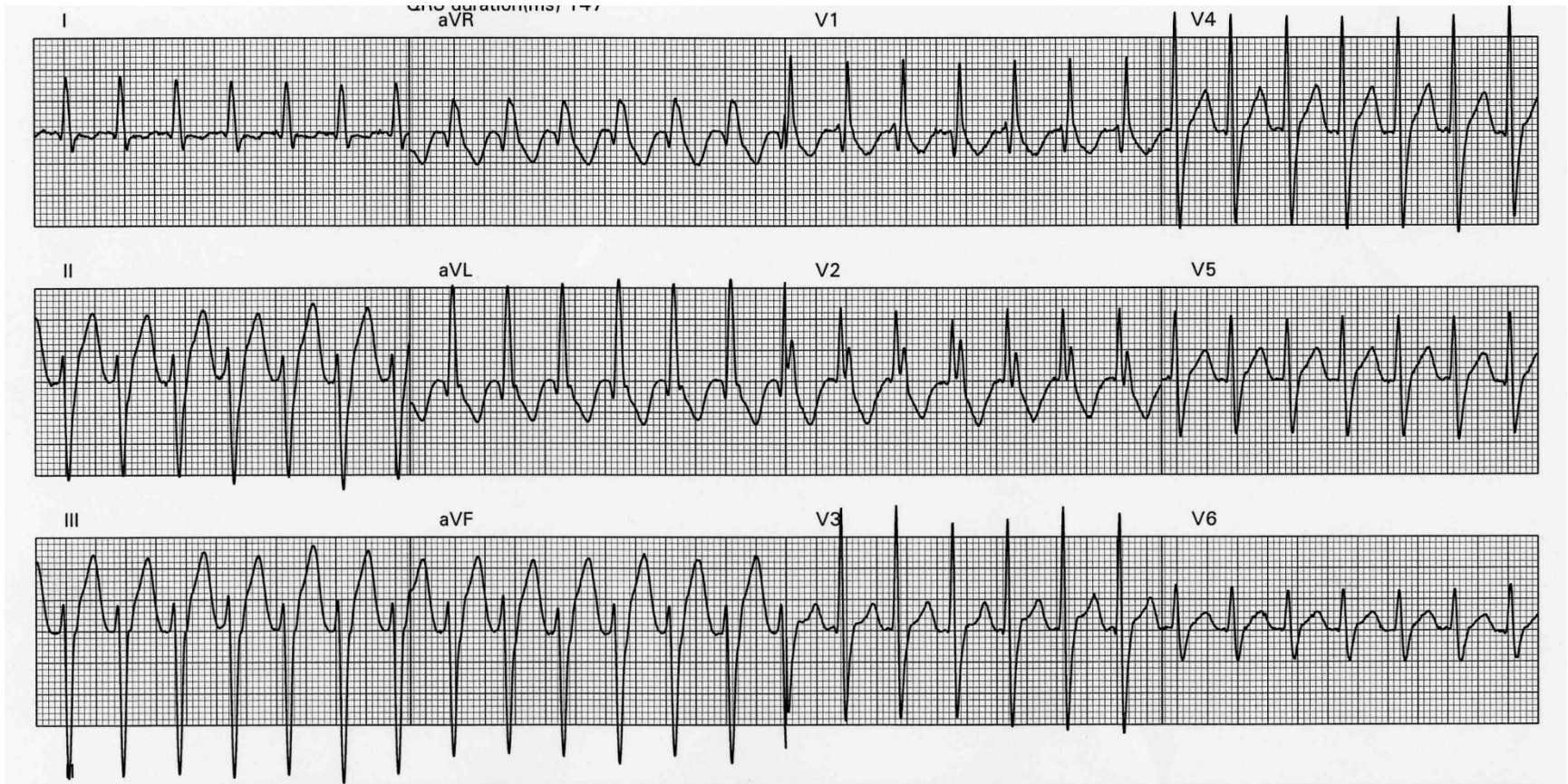


흉부 유도과 실제 심장과와의 관계



V1,2 : septal
V3,4 : anterior
V5,6 : lateral

16세 남자. 심계항진
VT의 origin은 ?



1) LV

2) RV

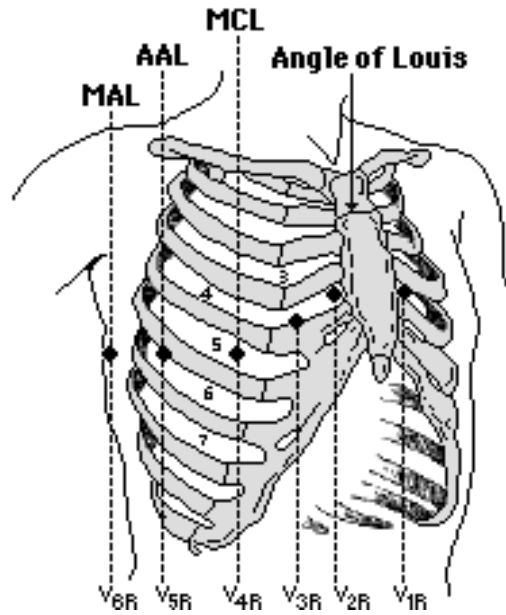
59세 여자. 심계항진
VT의 origin은 ?



1) LV

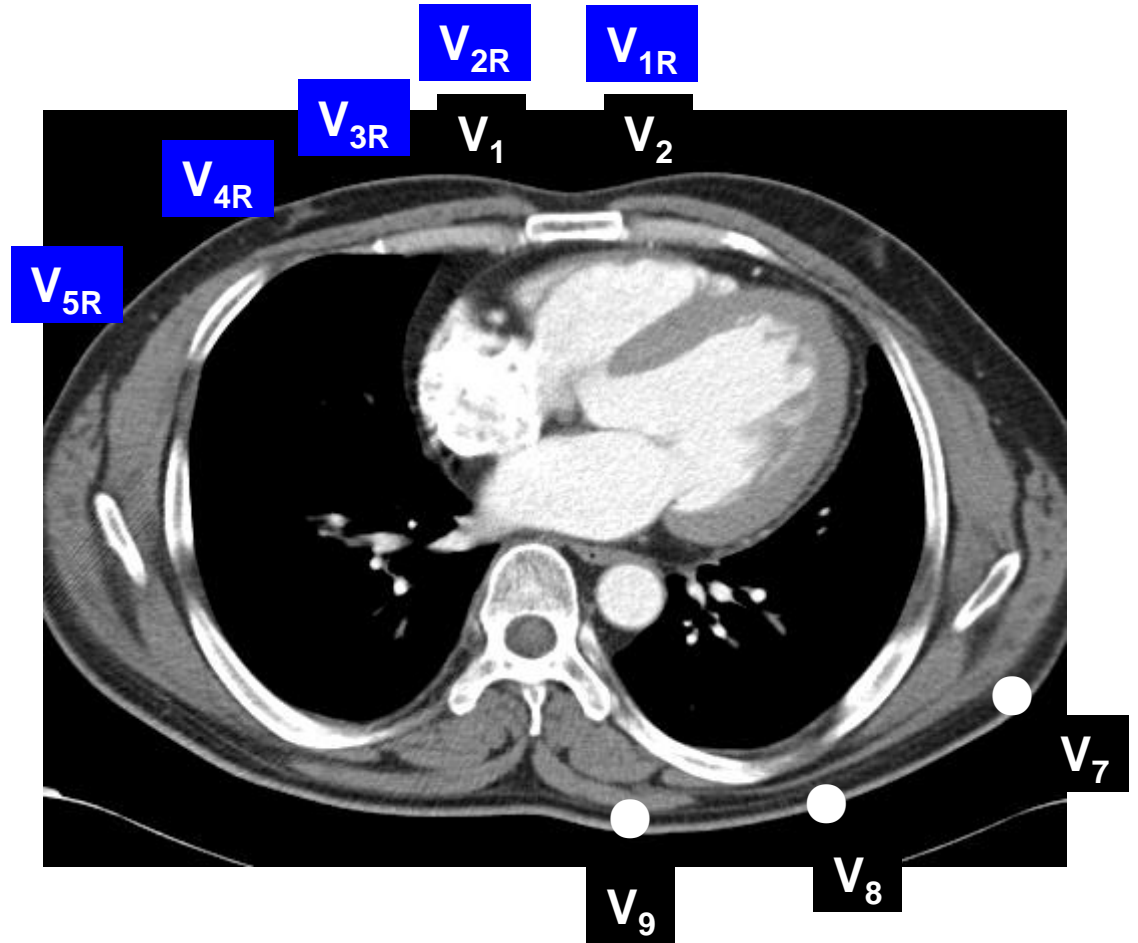
2) RV

RIGHT PRECORDIAL LEADS



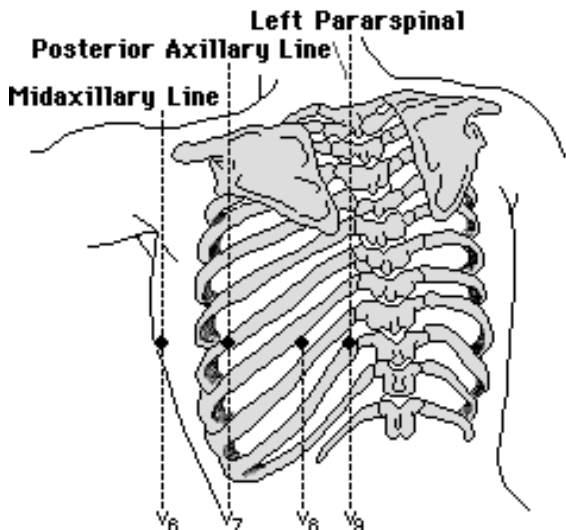
<https://wikis.engage.com>

특수유도



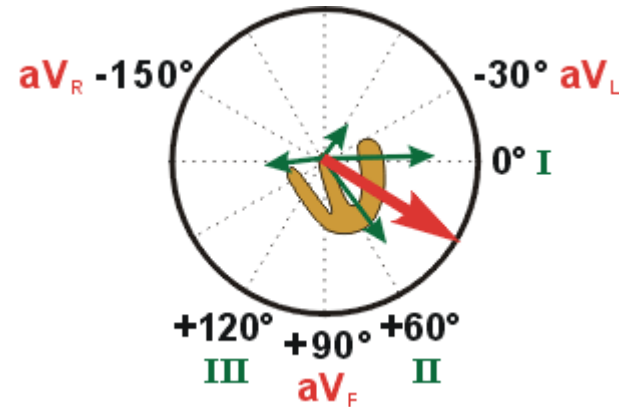
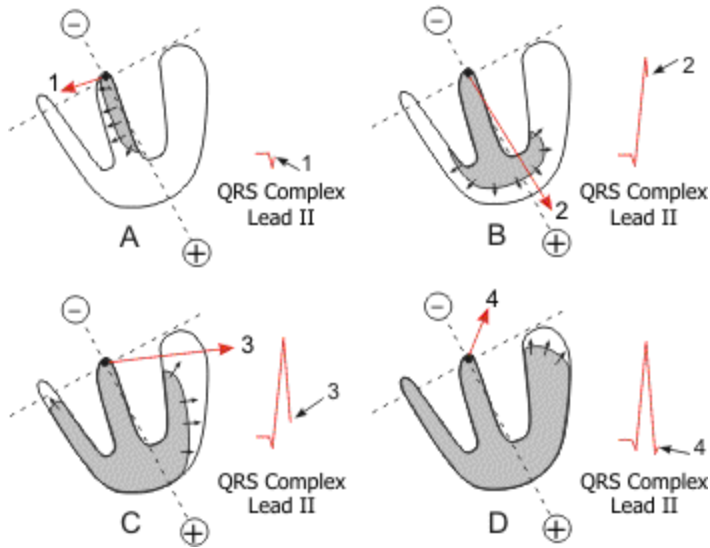
V_{6R}

LEFT POSTERIOR LEADS

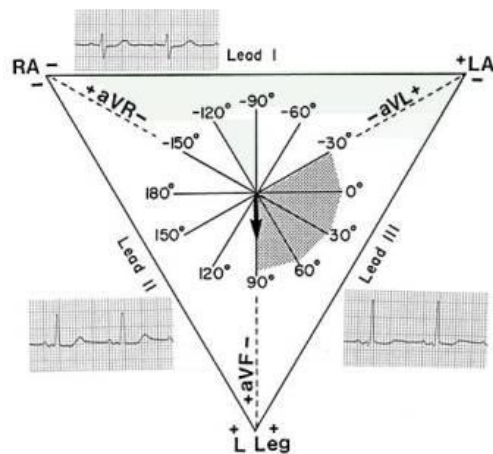


<https://wikis.engage.com>

Ventricular activation and axis



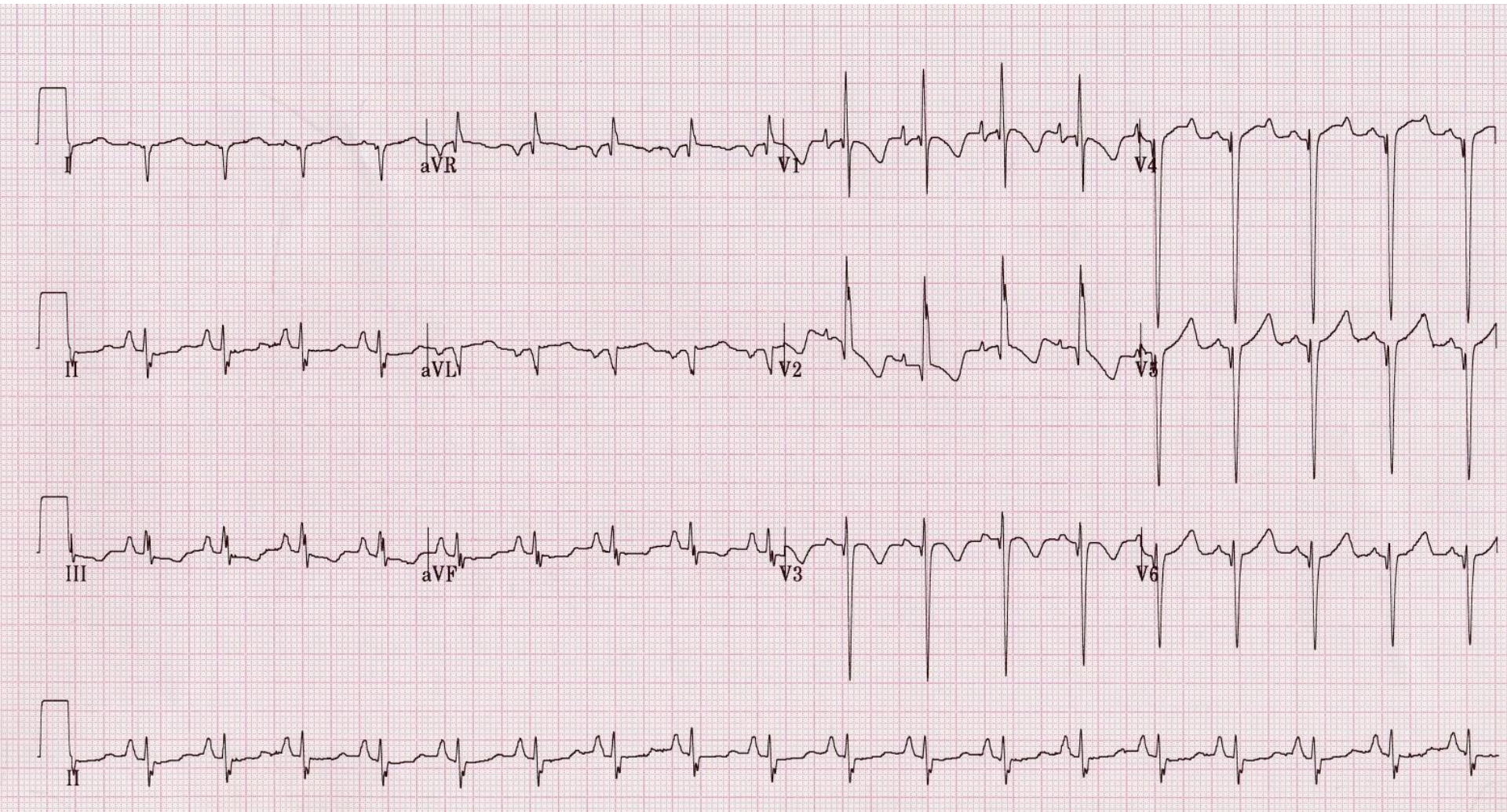
<http://www.cvphysiology.com/Arrhythmias/A016.htm>



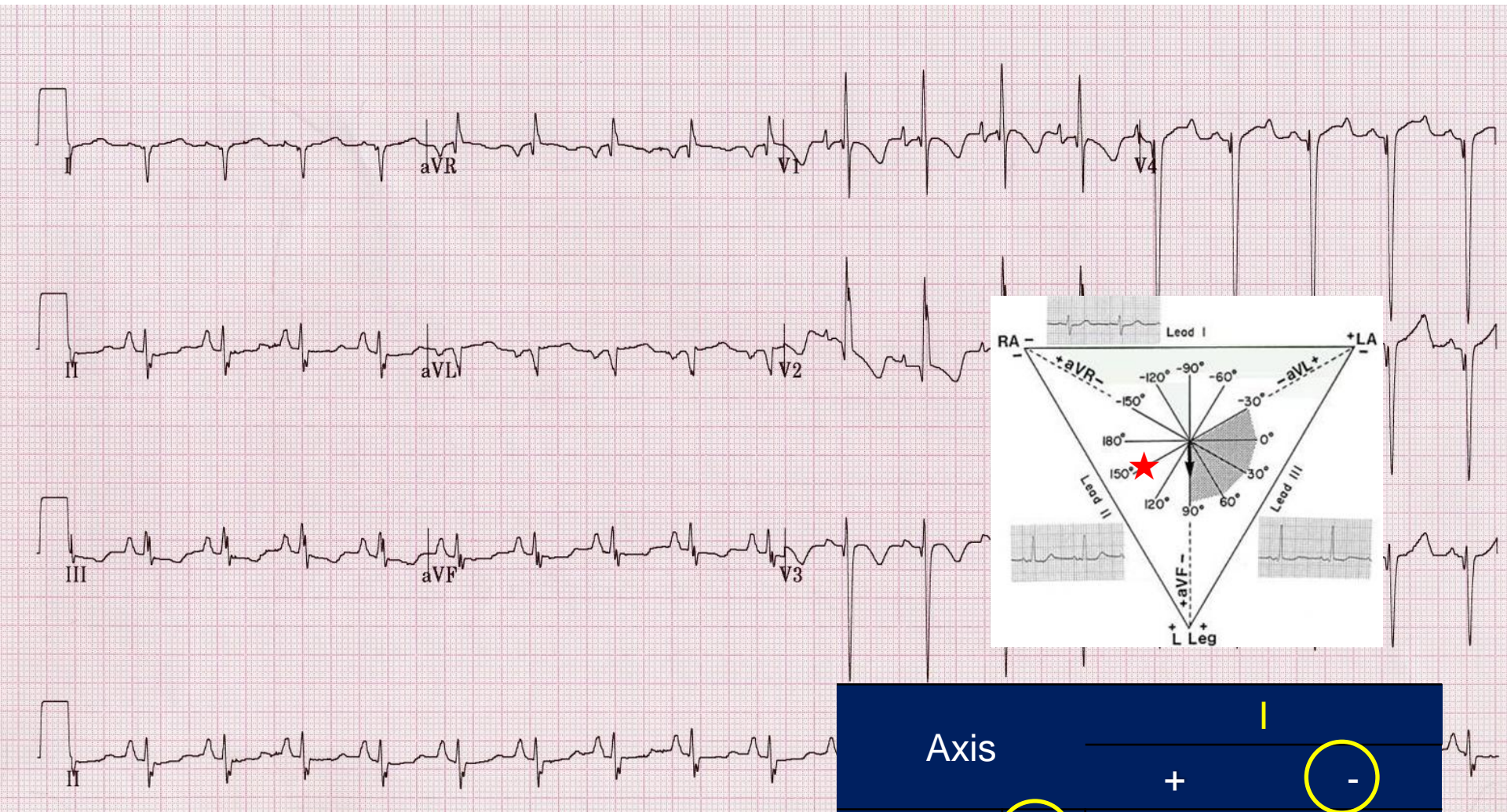
Axis	I	
	+	-
aVF	+	Normal RAD
	-	LAD/N* extreme

* II (-), LAD; (+), normal

이 심전도의 전기축(axis)은 ?

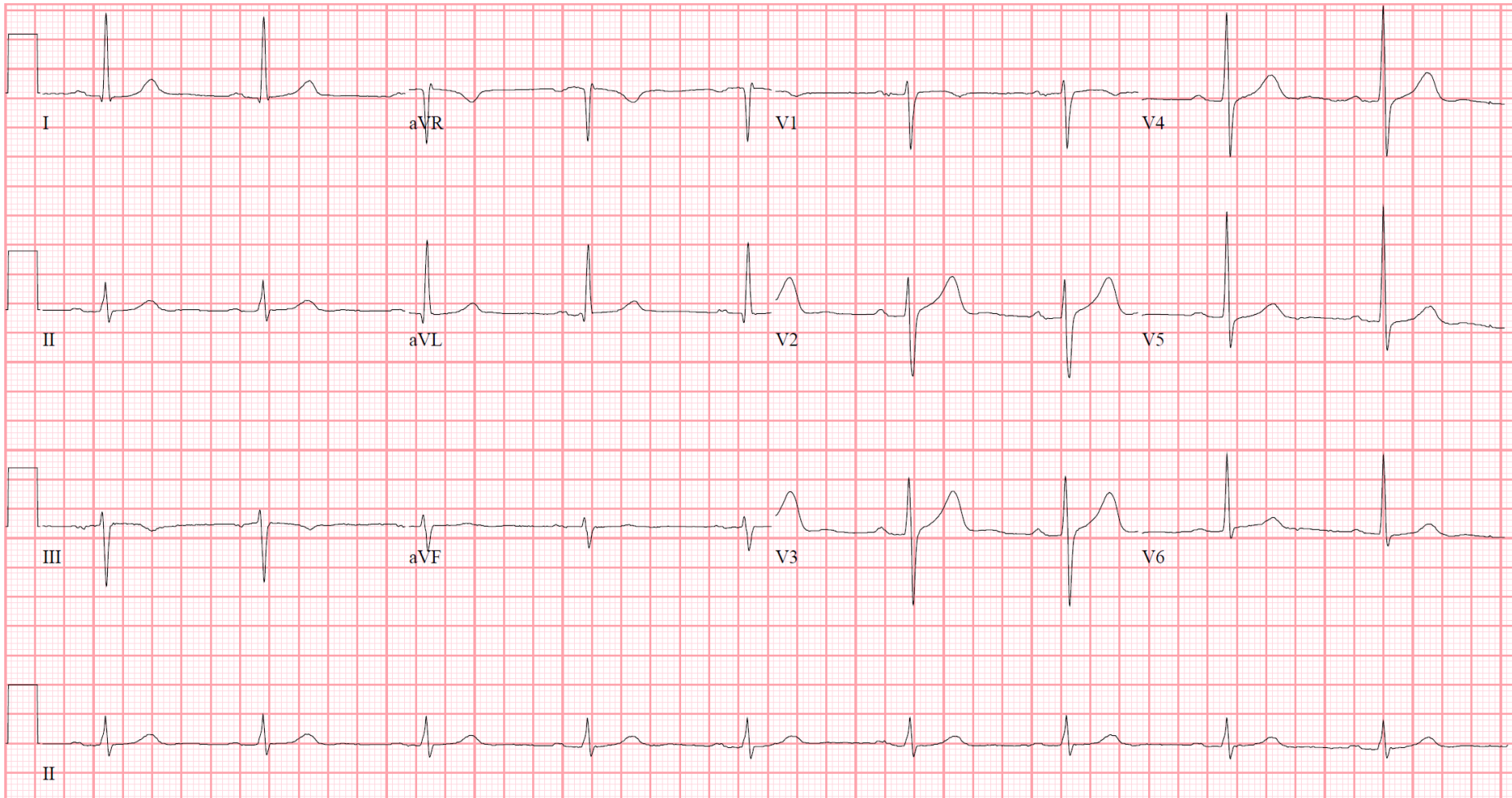


- 1) Normal 2) Left axis deviation 3) Right axis deviation 4) Extreme axis deviation

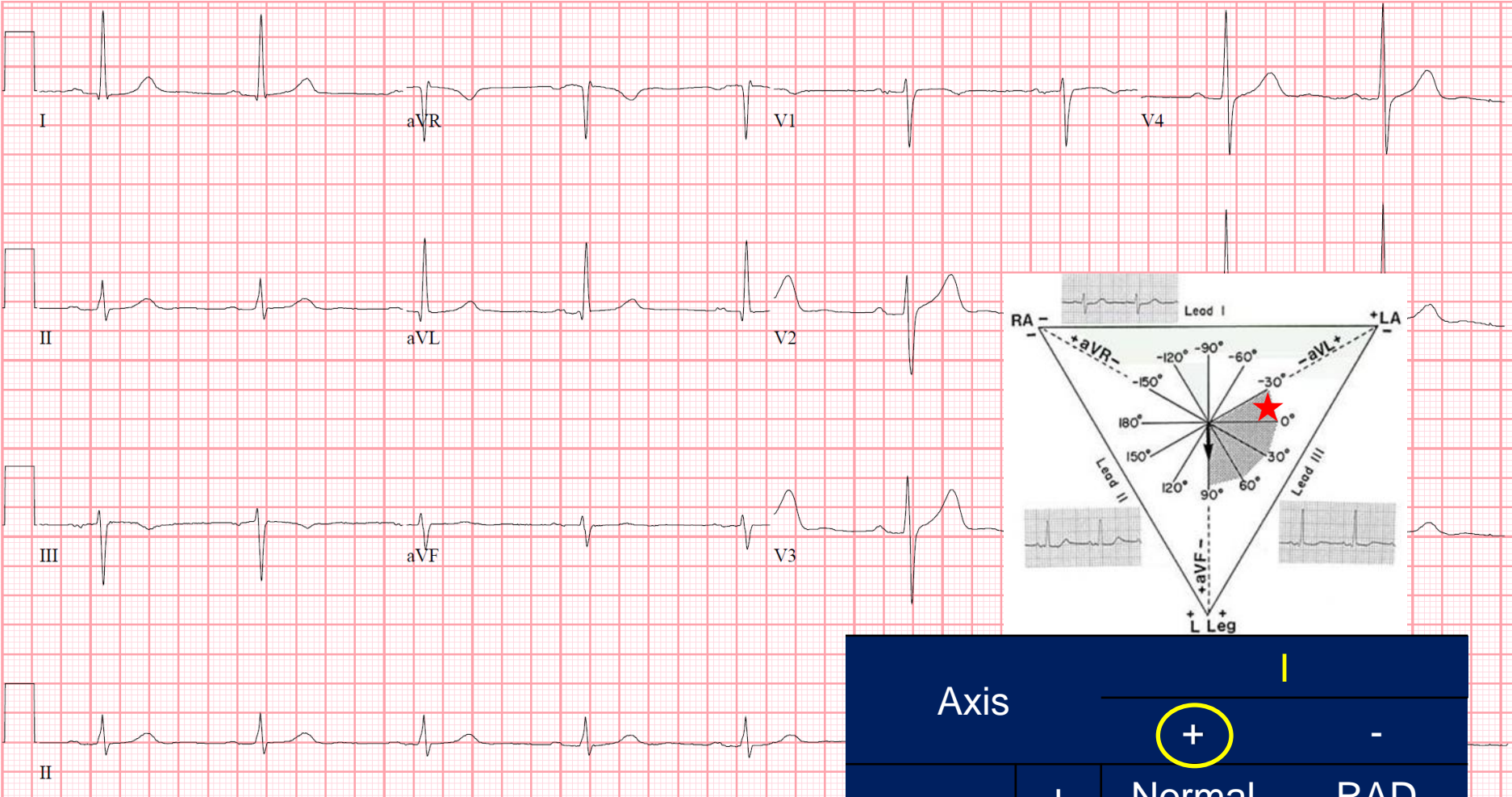


Axis		I	
		+	-
aVF	+	Normal	RAD
	-	LAD/N*	extreme

이 심전도의 전기축(axis)은 ?



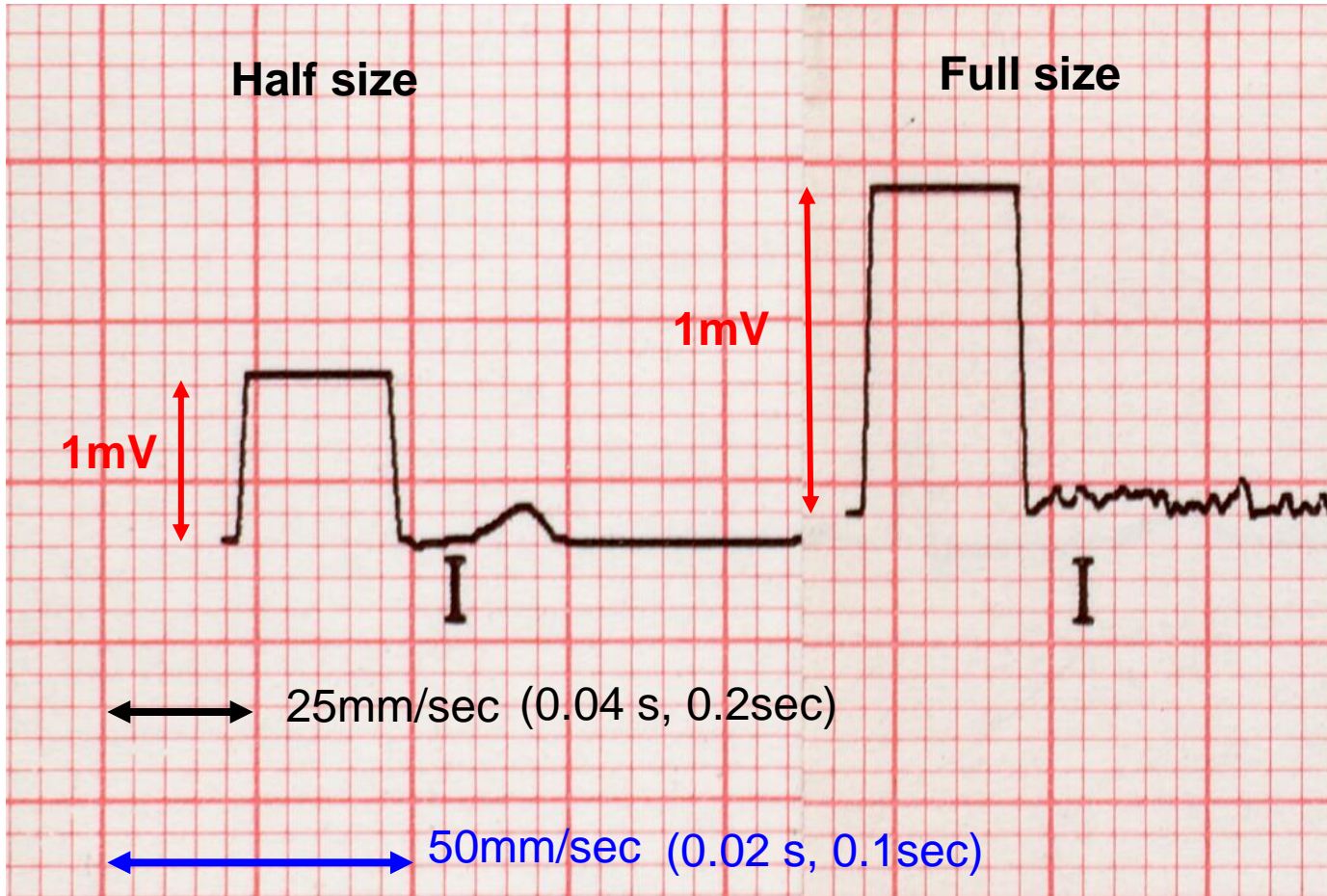
- 1) Normal 2) Left axis deviation 3) Right axis deviation 4) Extreme axis deviation



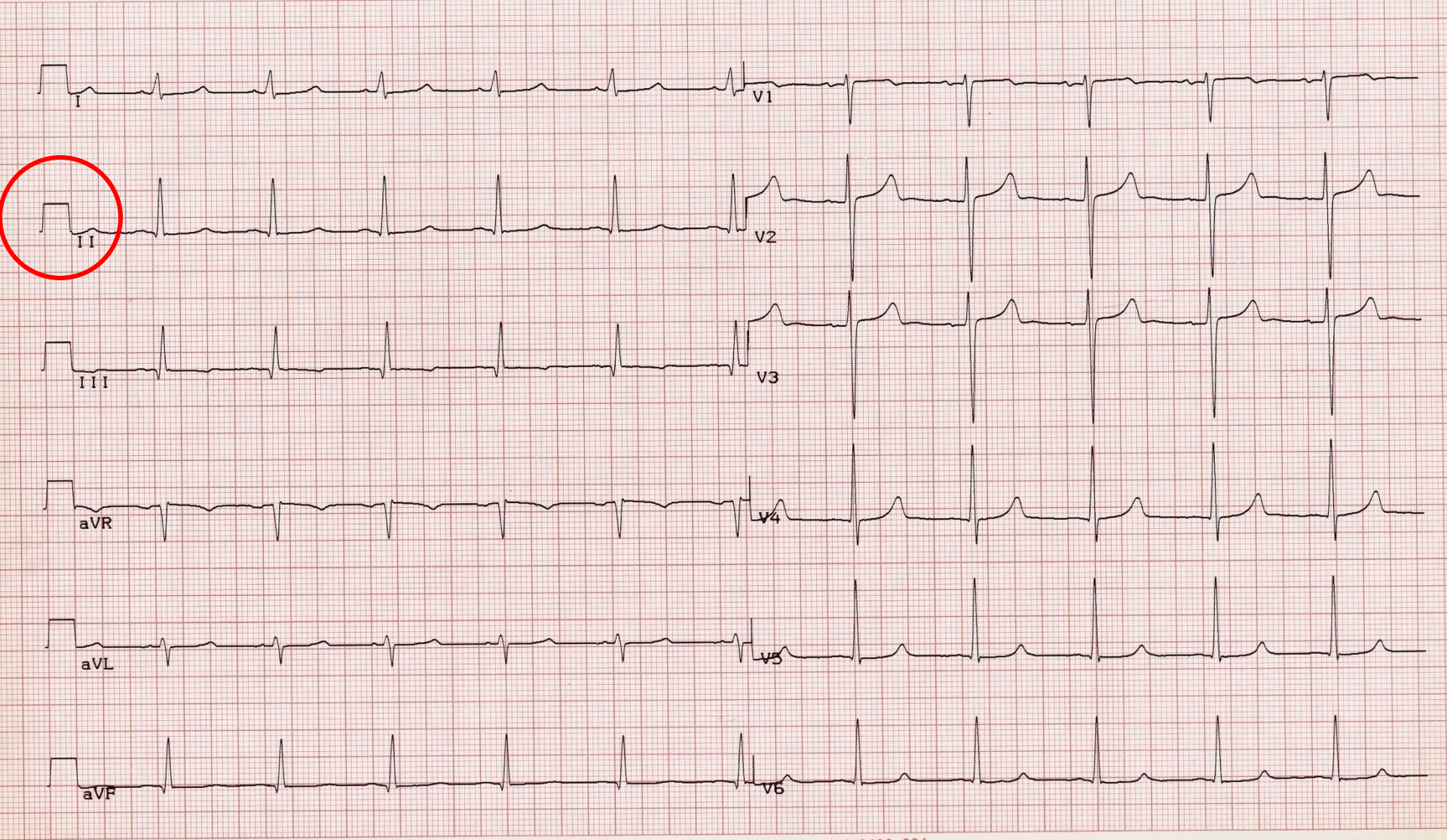
Axis		I	
		+	-
aVF	+	Normal	RAD
	-	LAD/ N*	extreme

* II (-), LAD; (+), normal

The ECG Paper



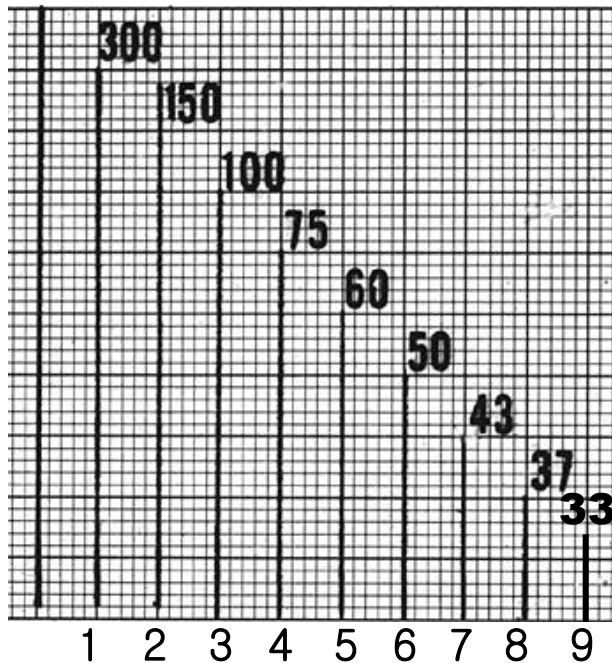
Half sized ECG



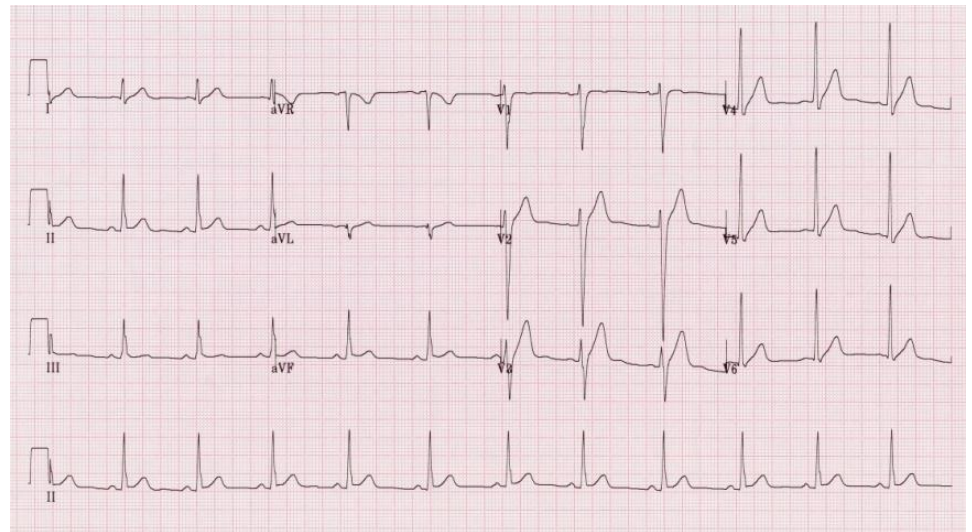
심박수 측정

1) 심박수 = $1500 / \text{QRS 길이 (mm)}$
* $25\text{mm/sec} = 1500\text{mm/분}$

2) Square counting



3) 10s rule



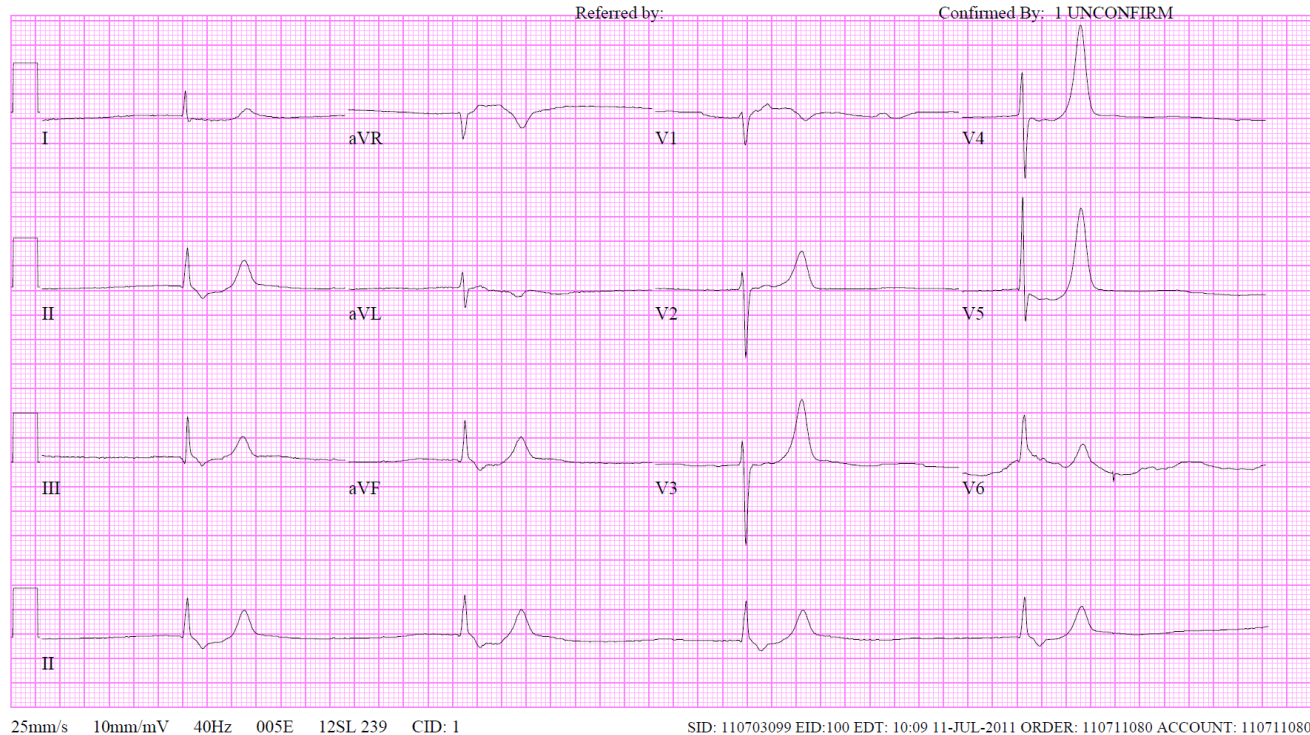
$$11 * 6 = 66$$

76세 여자, 전신 쇠약감으로 응급실 방문, K 7.0mEq/L 심박수는 ?

03-JAN-1935 (76 yr)
Female Oriental

Vent. rate			
PR interval		ms	
QRS duration	90	ms	
QT/QTc	628/412	ms	
P-R-T axes	* 71	83	

*** Poor data quality, interpretation may be adversely affected
Junctional bradycardia
Nonspecific ST and T wave abnormality
Abnormal ECG

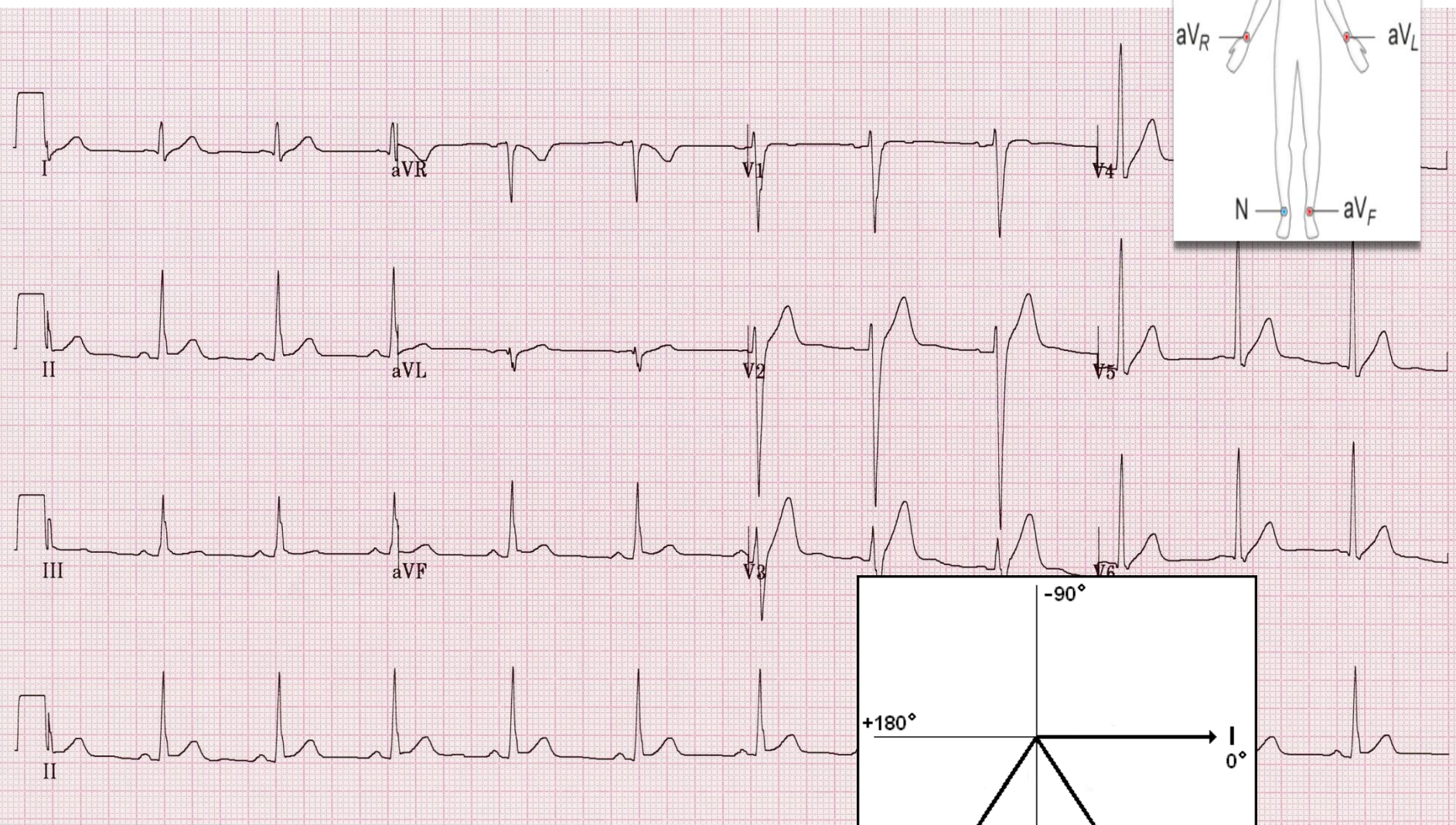
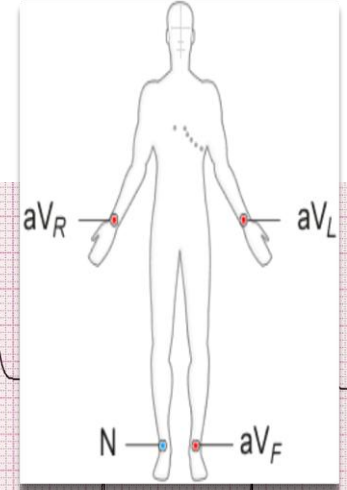


- 1) $1500/57 = ?$ 2) $4 * 6$ 3) 11칸이면 ? 4) 심전도 기록지 본다

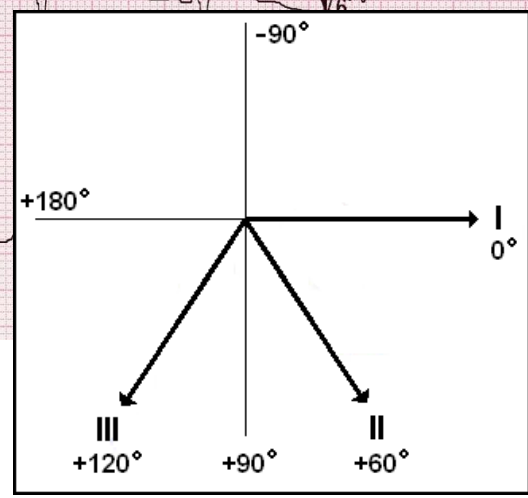
심전도 오판독의 원인

- 부적절한 전극의 부착
- 전극의 불완전한 접촉
- 근육 떨림

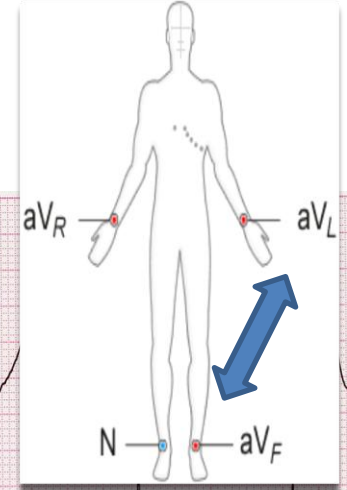
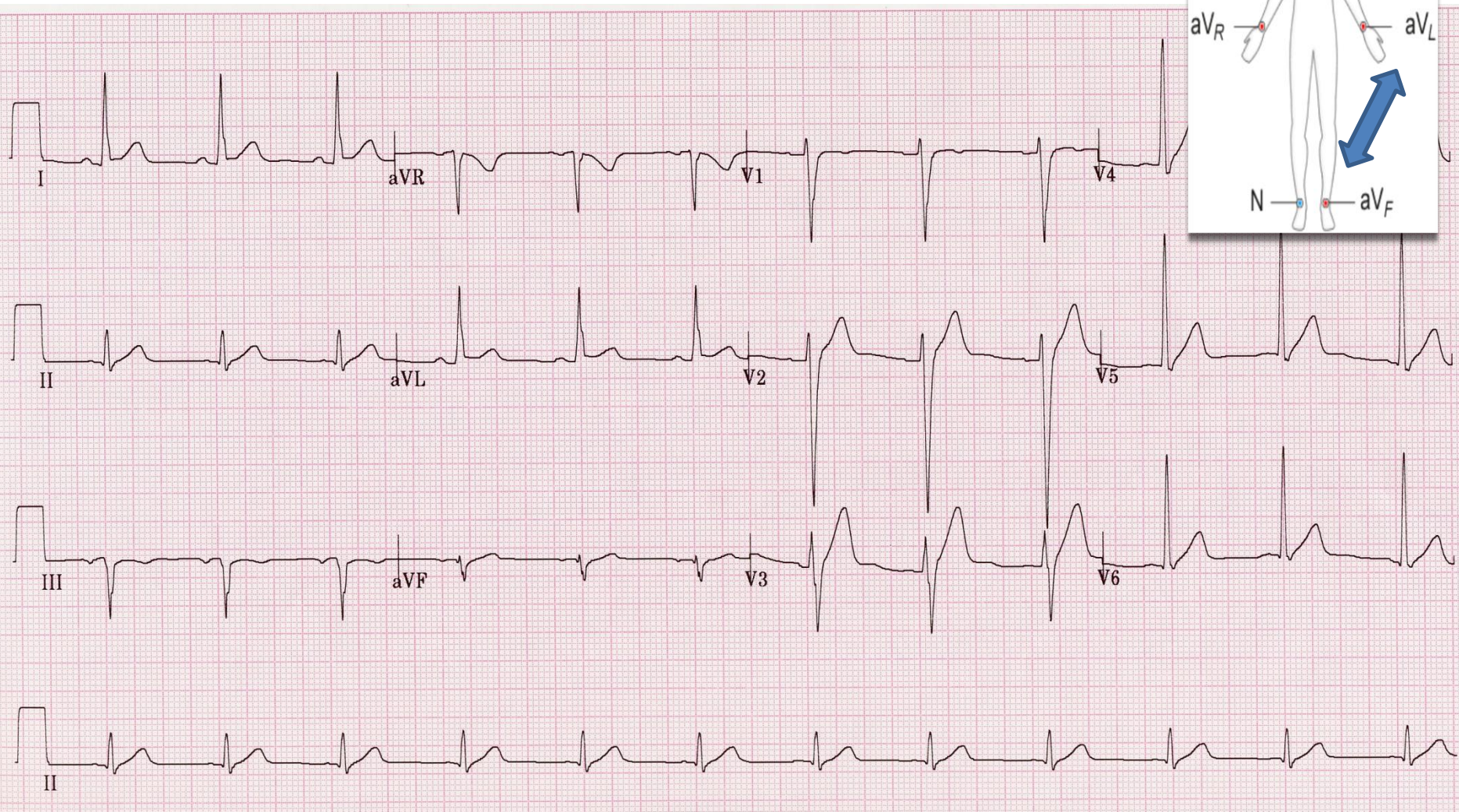
Correct Frontal ECG Lead



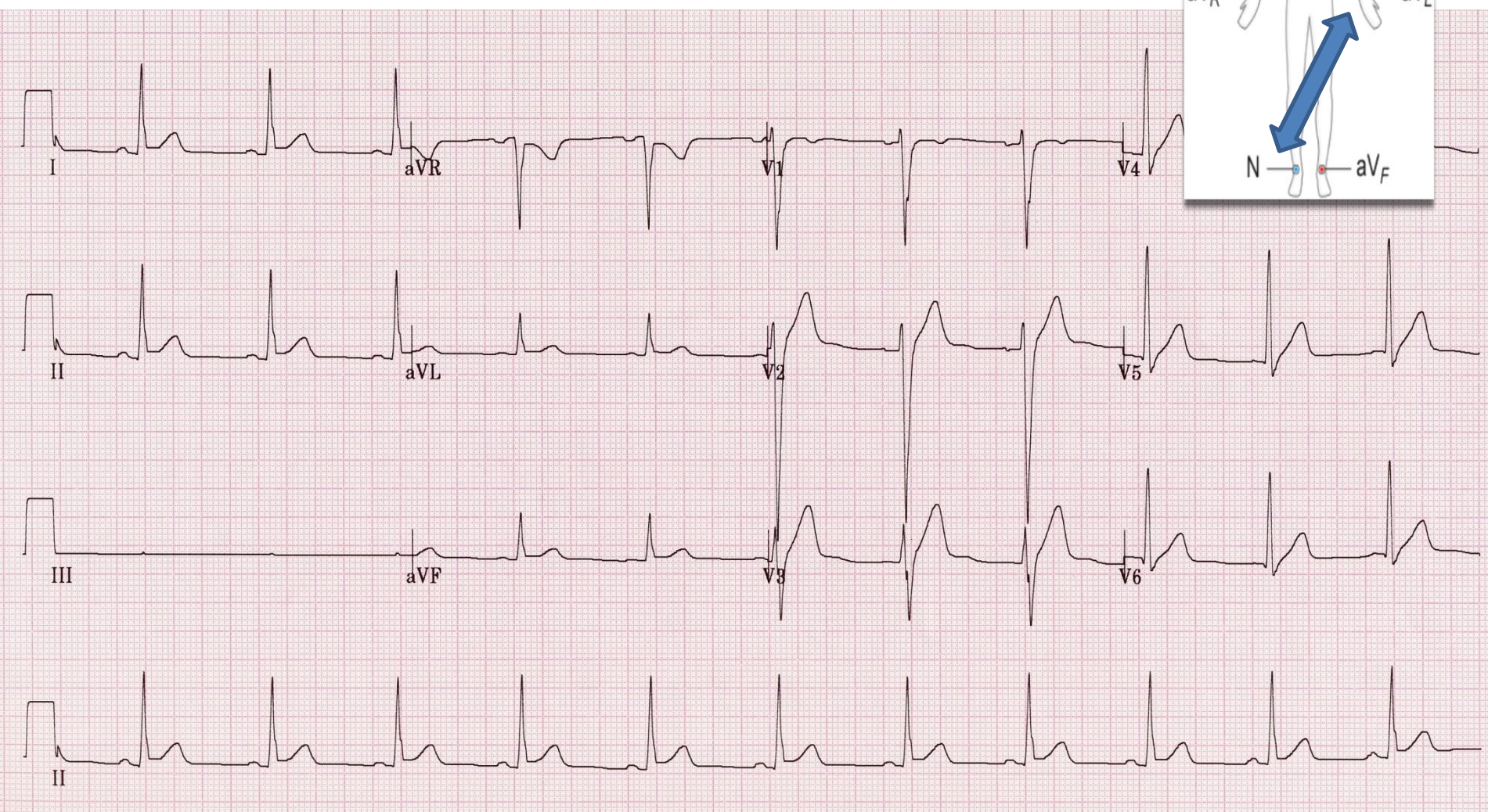
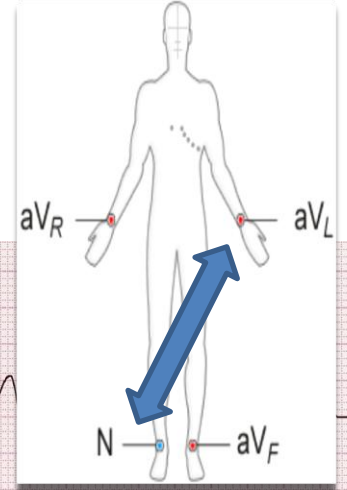
Einthoven's law : I + III = II



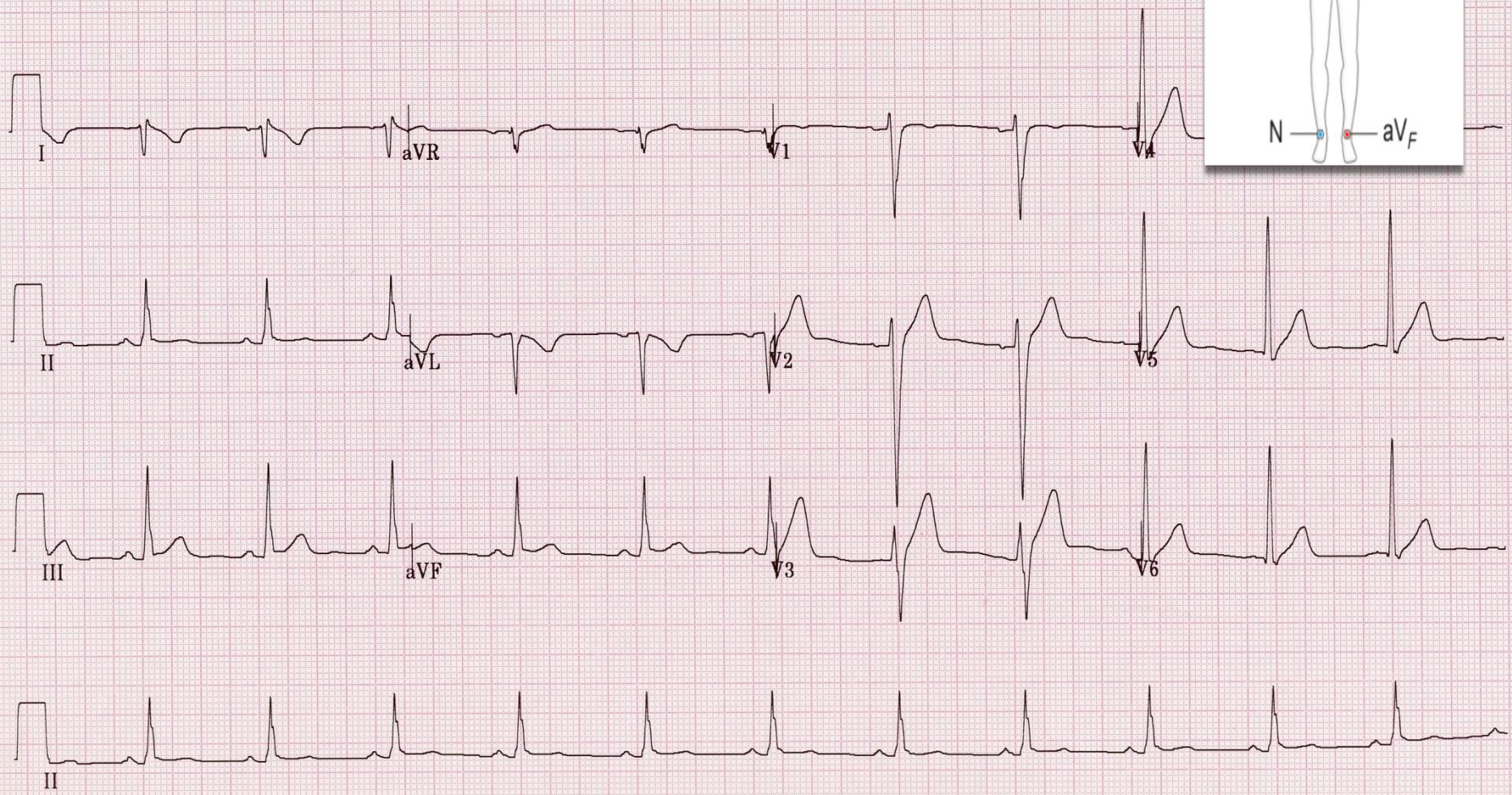
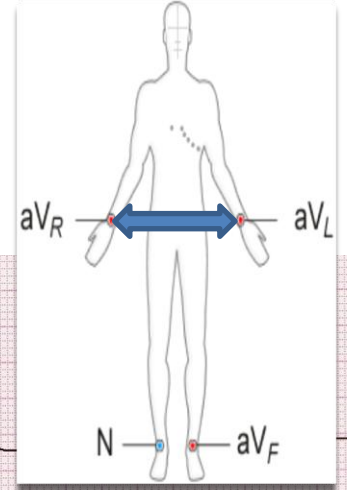
Left Arm ↔ Left Leg



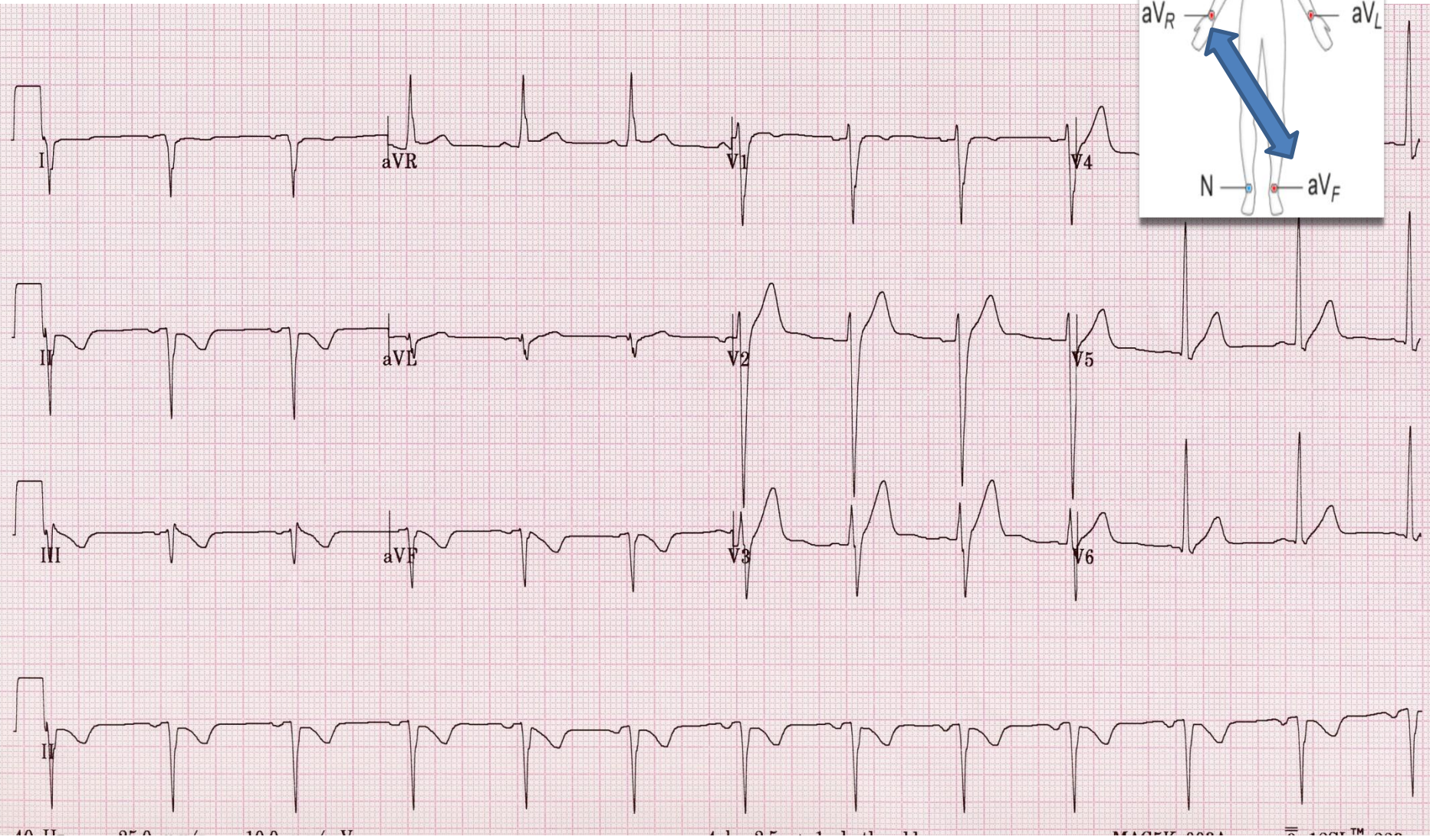
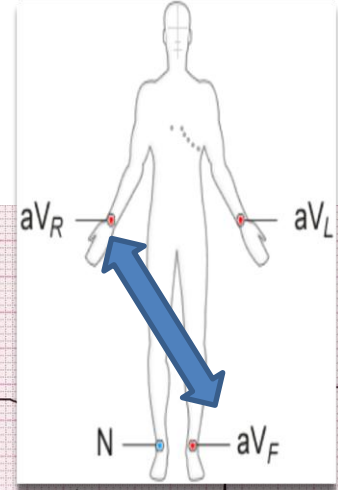
Left Arm ↔ Right Leg



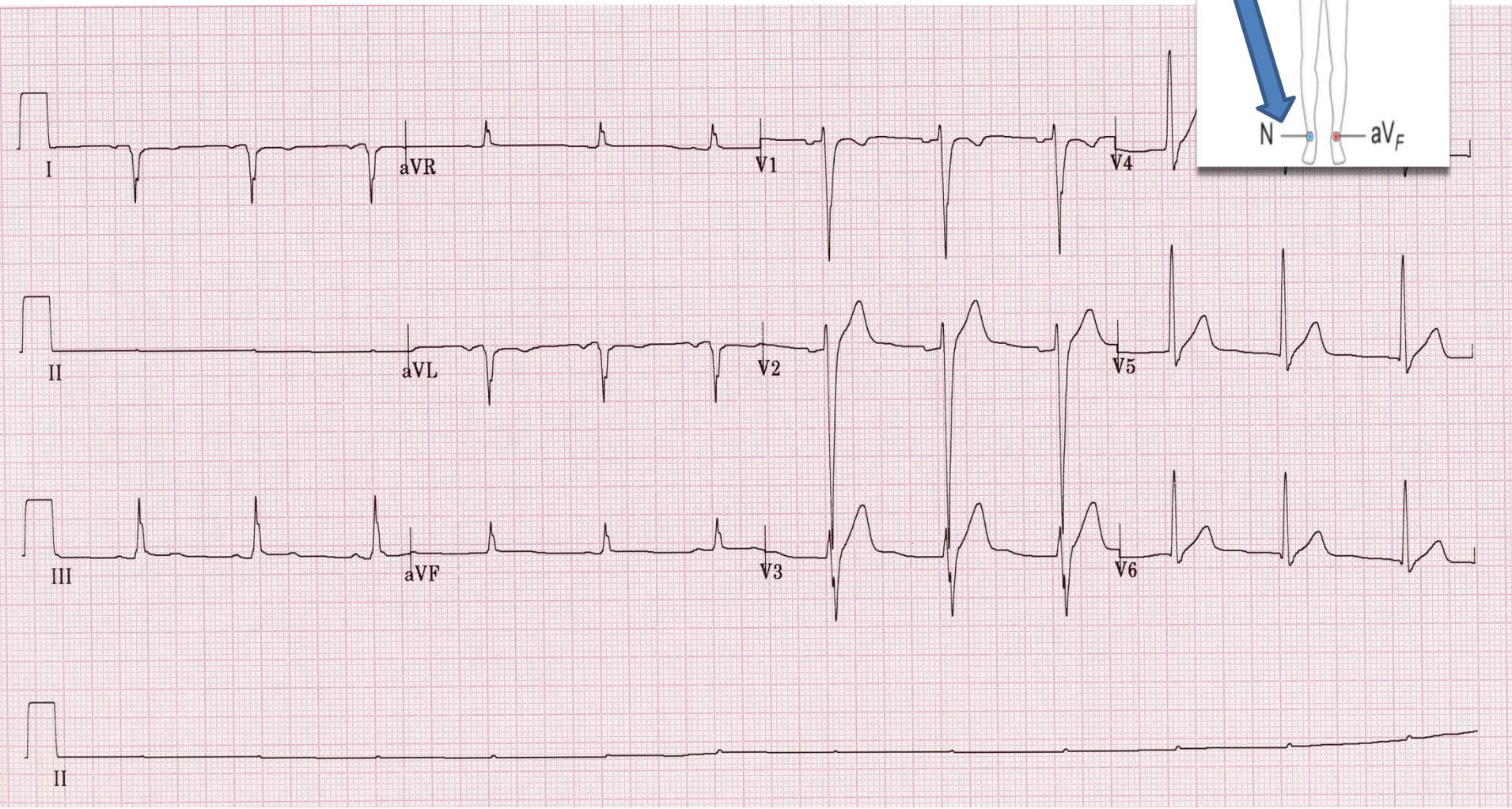
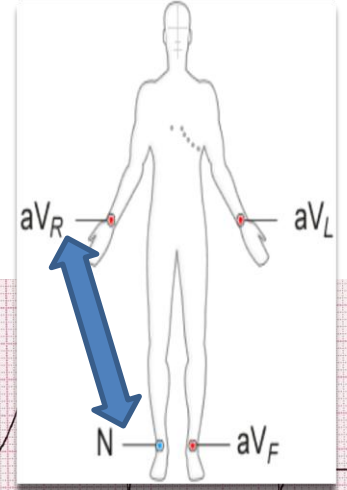
Right Arm ↔ Left Arm



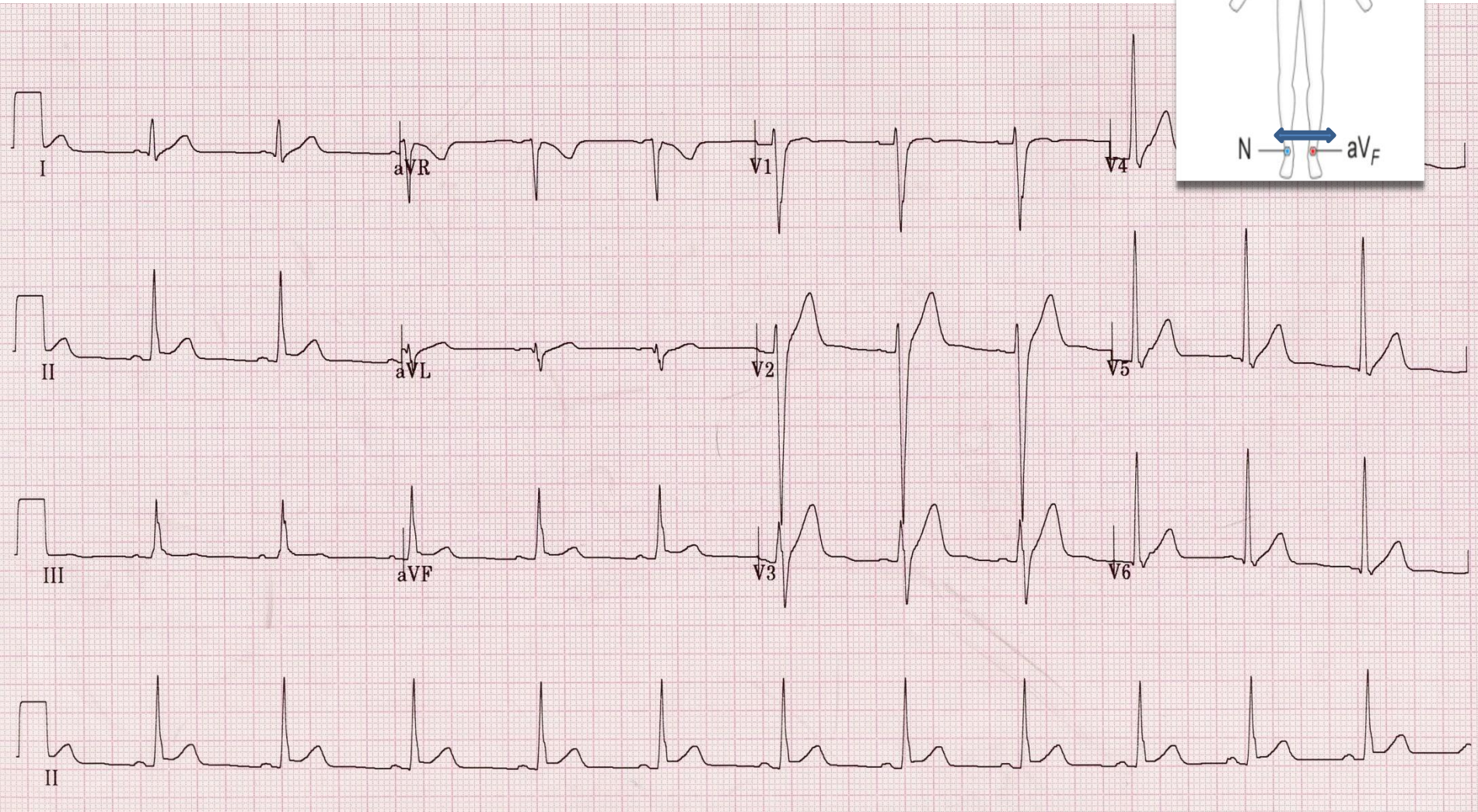
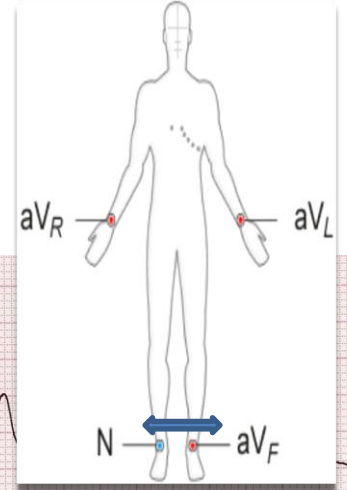
Right Arm ↔ Left Leg



Right Arm ↔ Right Leg



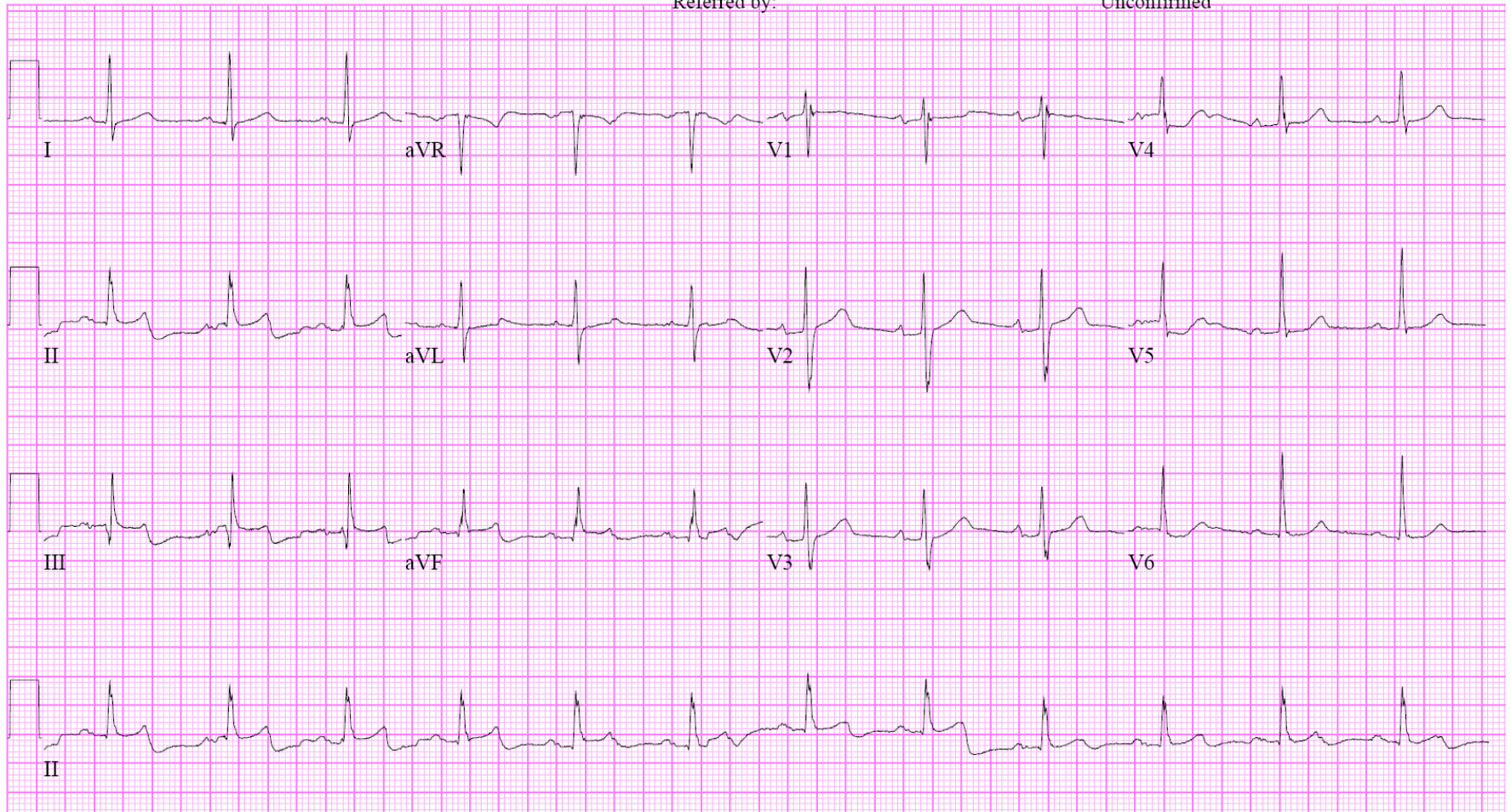
Right Leg ↔ Left Leg



72세 남자, 운동시 흉통, 혈압 160/92mmHg
이 심전도의 진단은 ?

Referred by:

Unconfirmed



1) AMI(inferior)

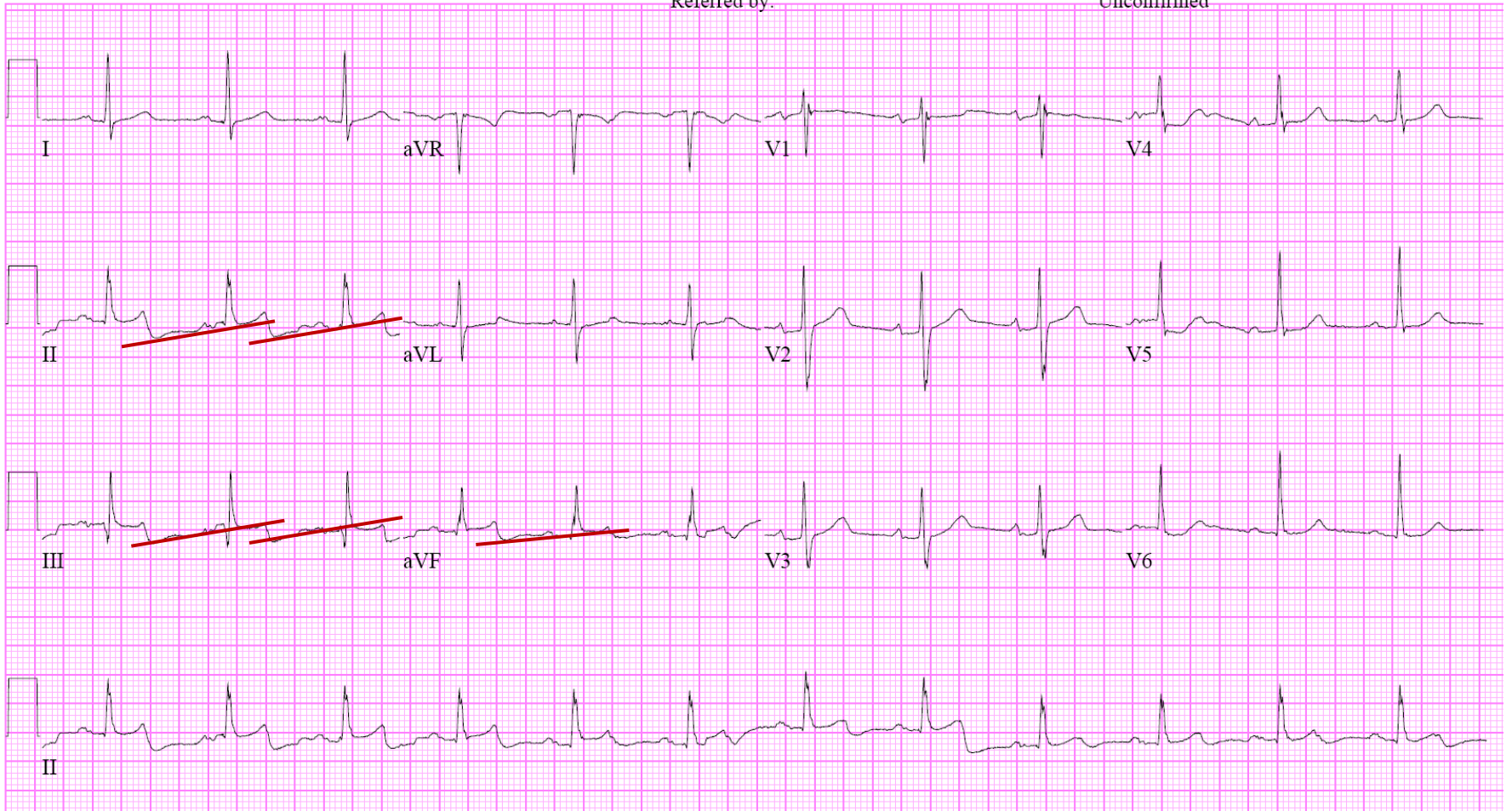
2) Lateral wall ischemia

3) Pericarditis

4) Recheck

Referred by:

Unconfirmed

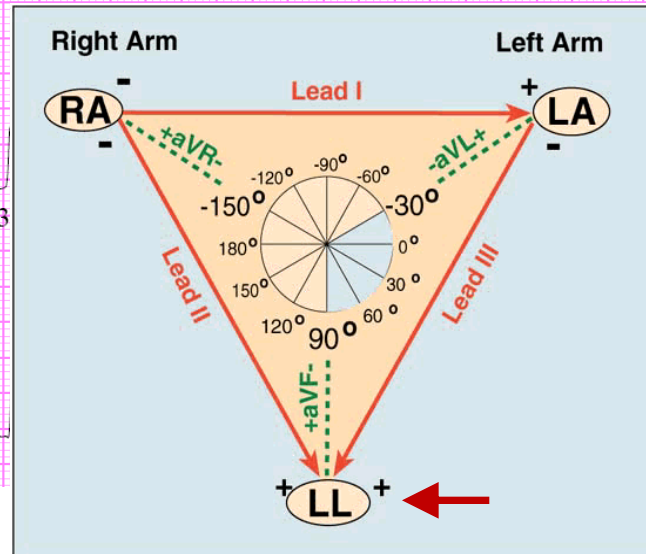
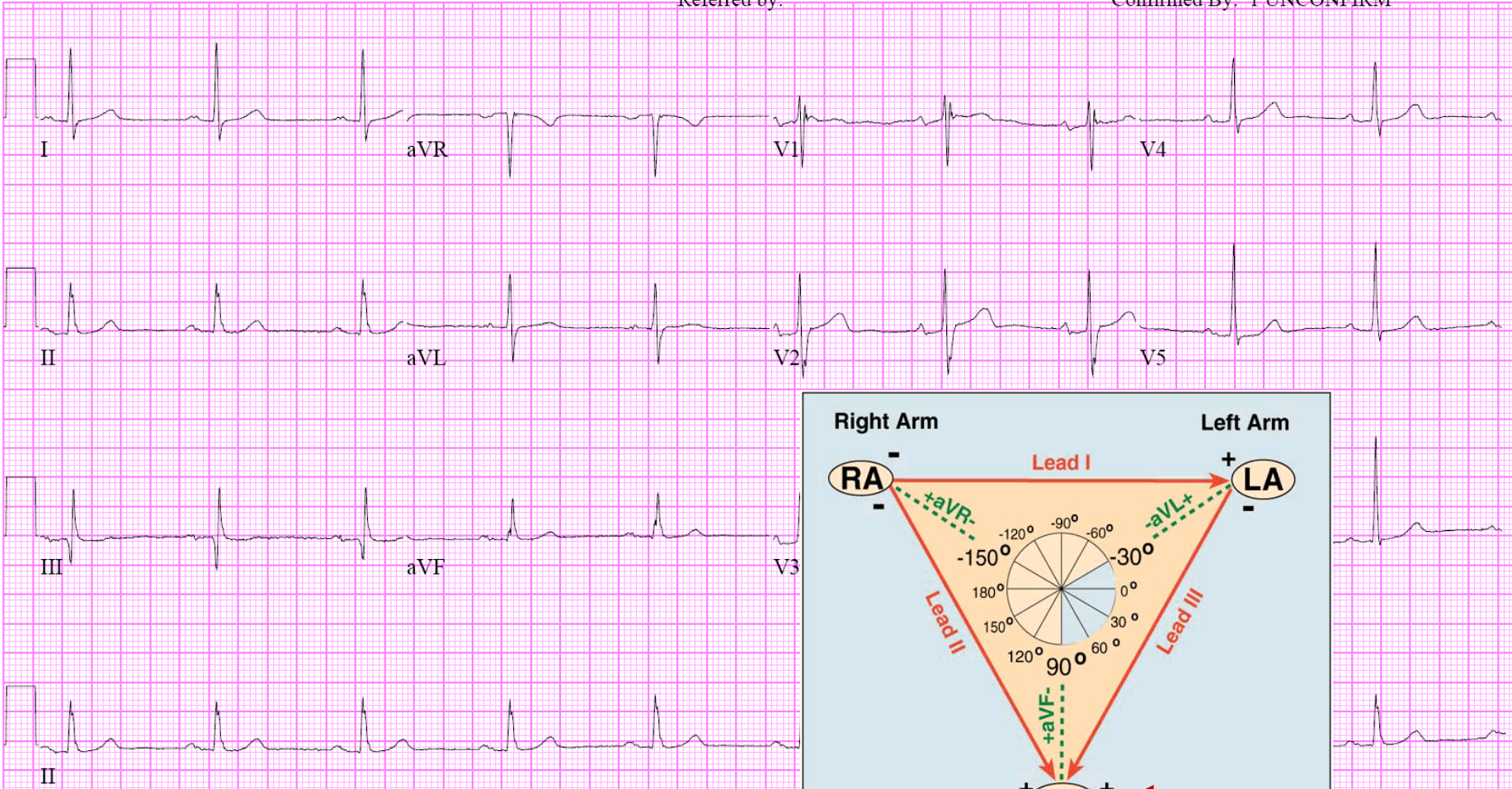


Baseline deviation in inferior leads

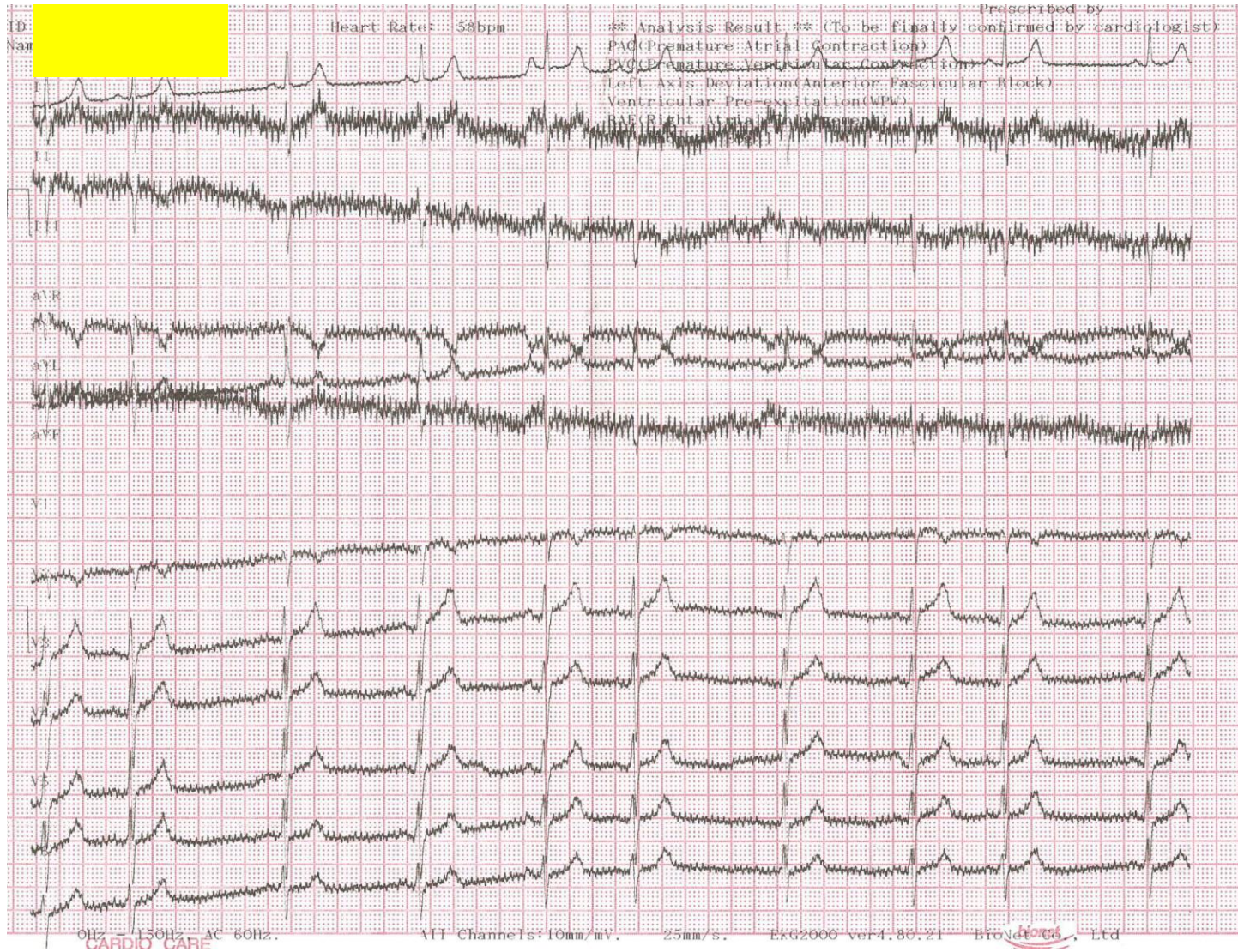
F/U ECG

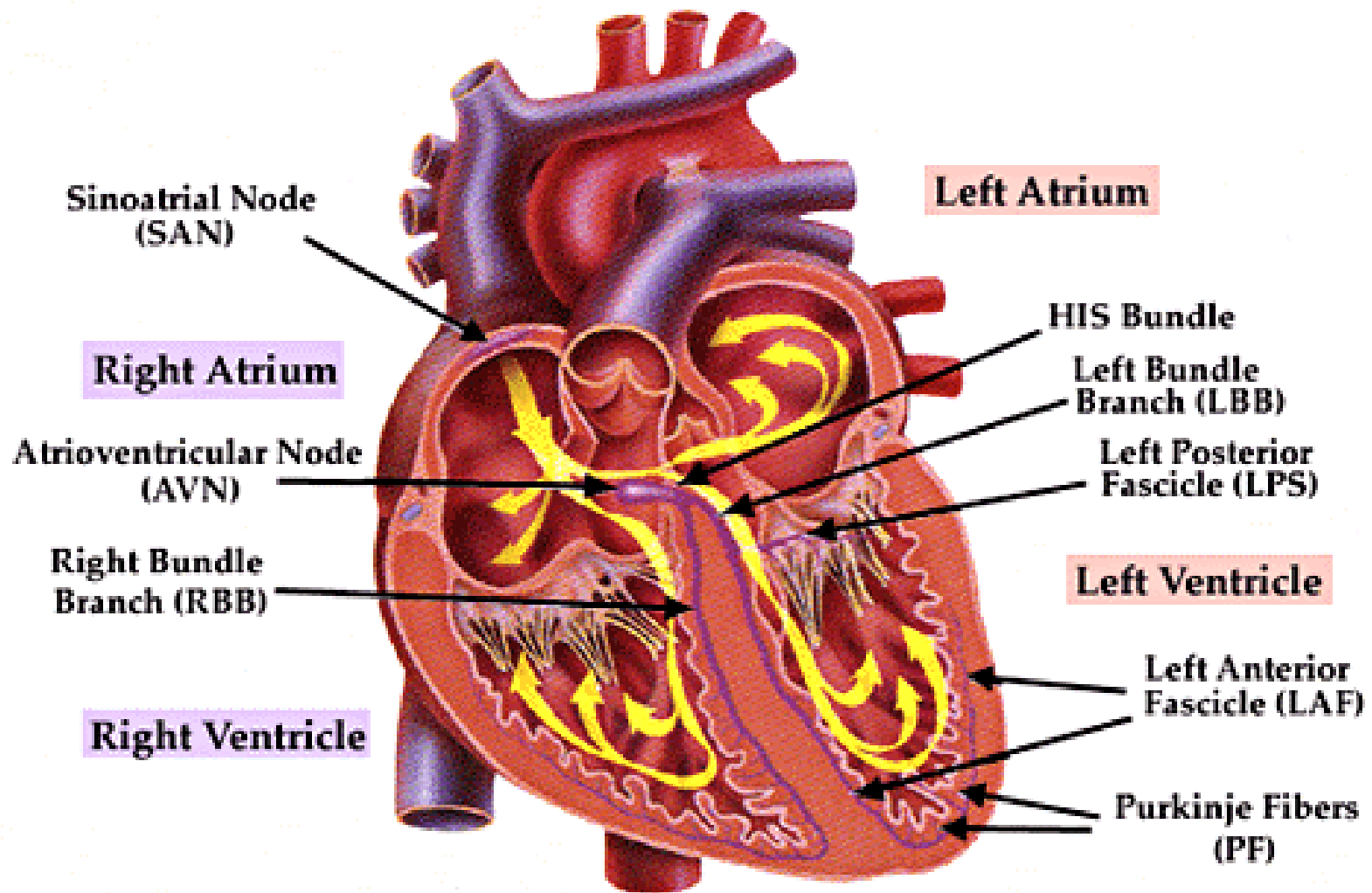
Referred by:

Confirmed By: 1 UNCONFIRM

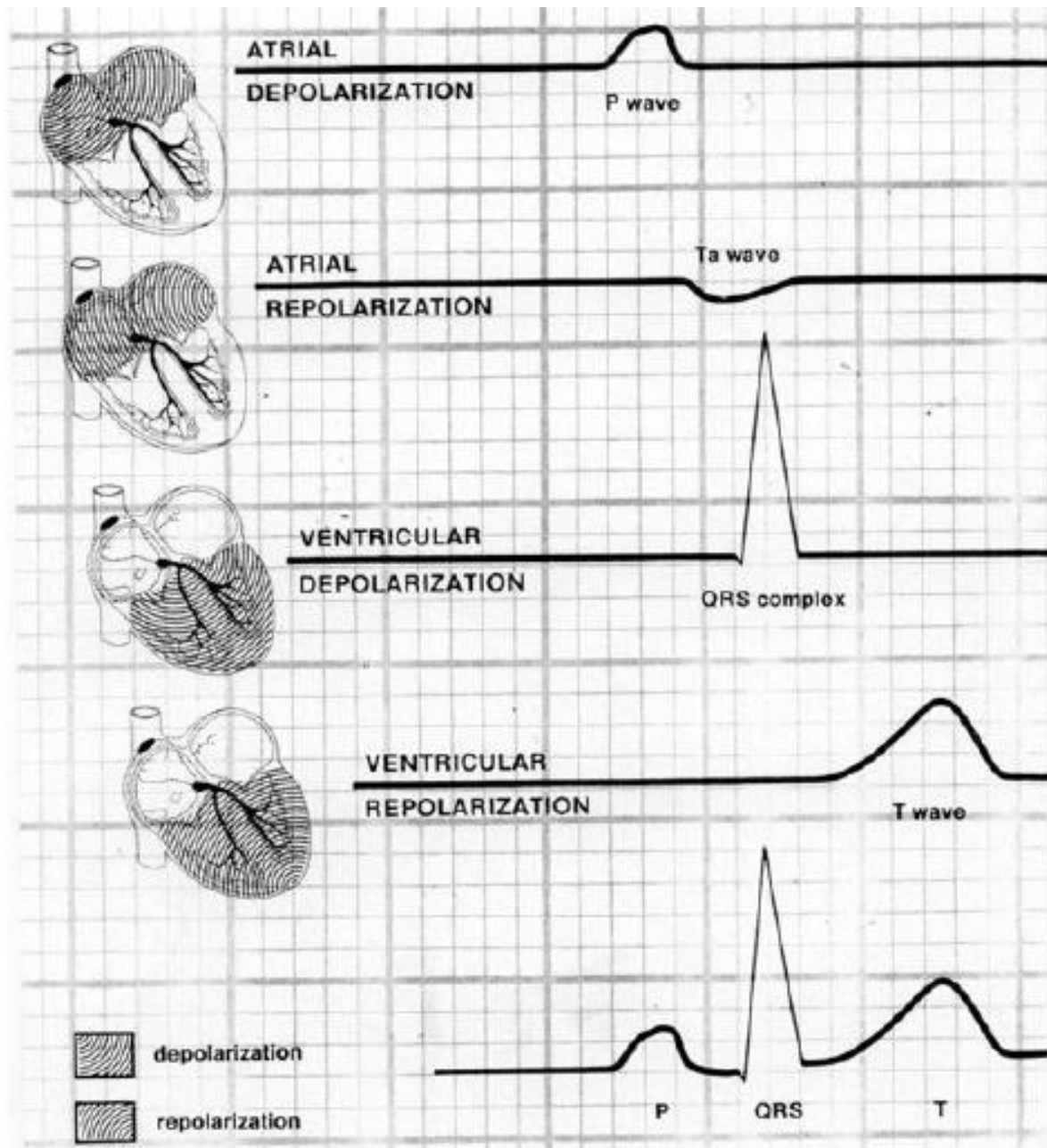


67세 여자, 심계항진으로 의뢰





Cardiac Conduction System

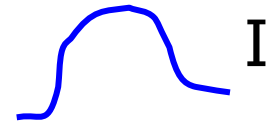


P wave morphology

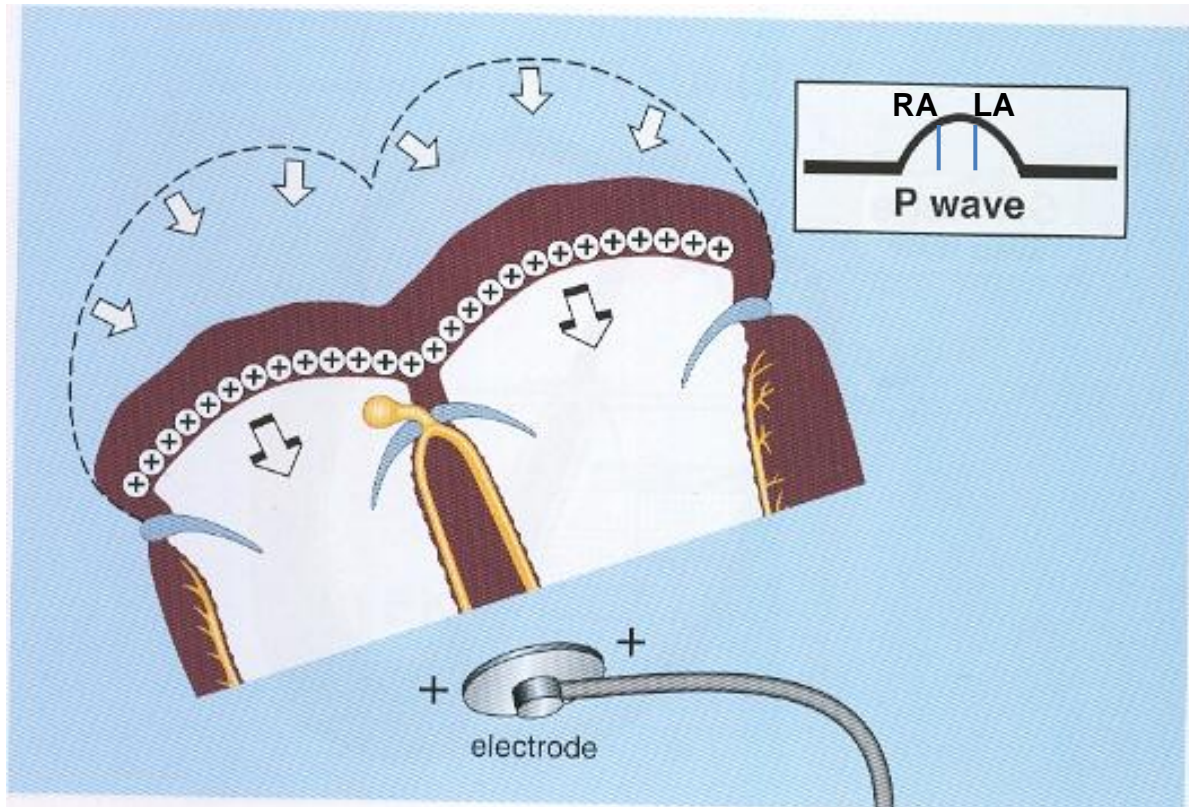
aVR



aVL



V1



V6

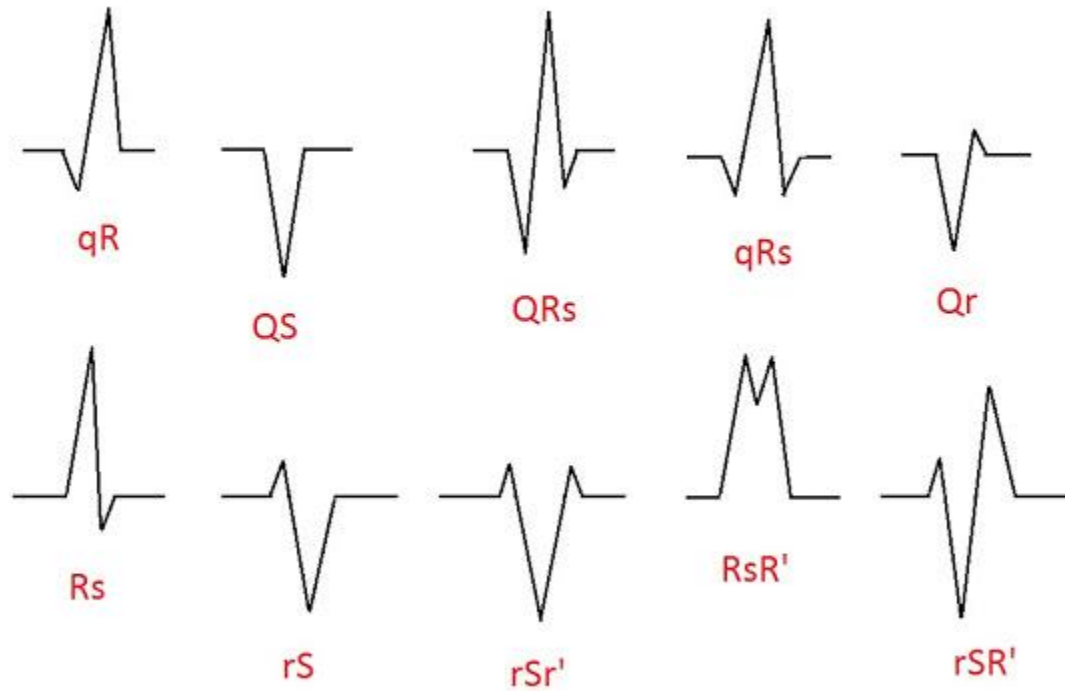
III



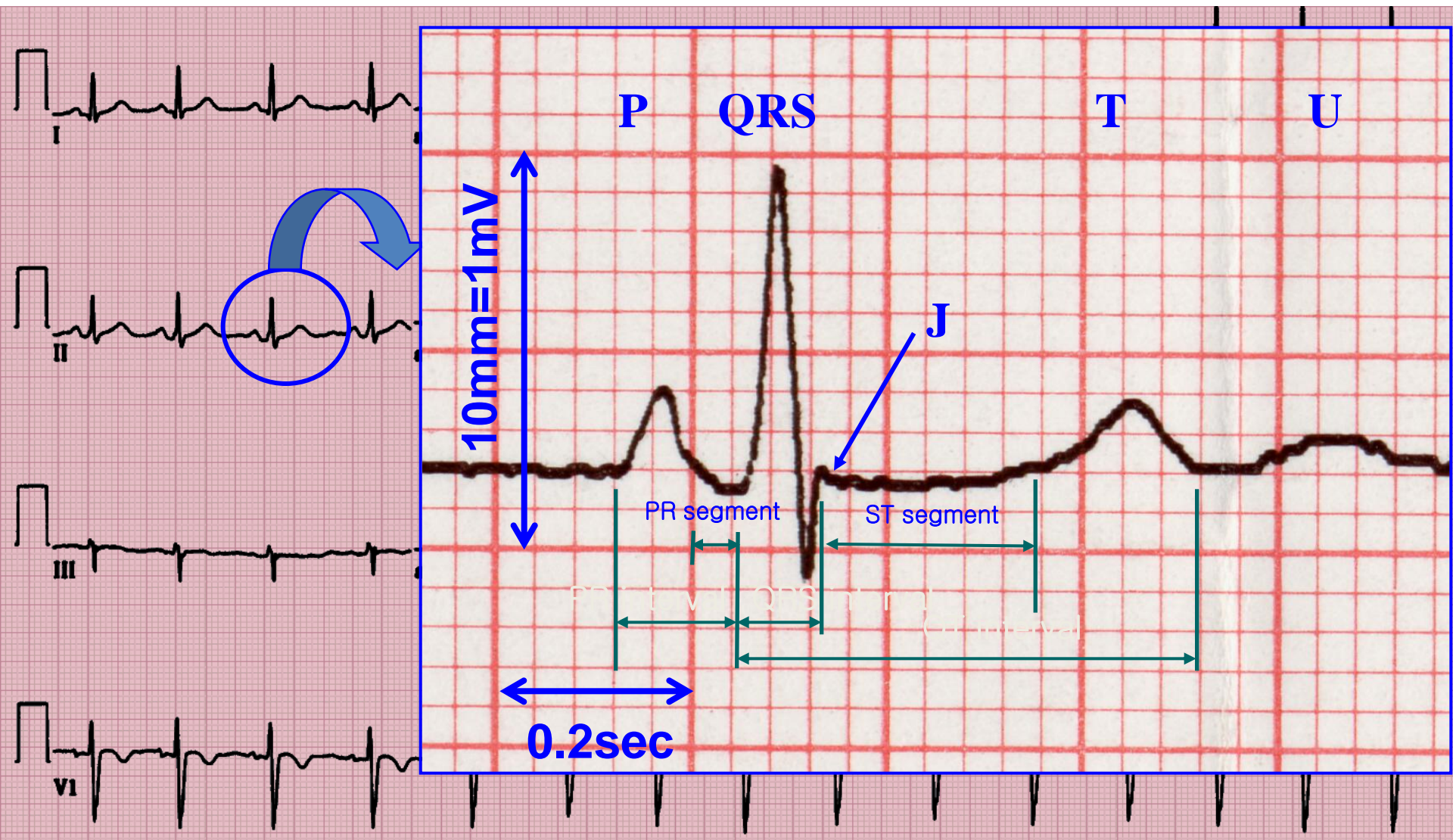
II

aVF

QRS complex morphology



기준 : 5mm



ECG wave summary

심전도 파와 간격	지표	의미	정상기준	비정상 일 때의 의미
P 파	폭	심방전도시간	<120ms	증가 :LAE
	크기	심방근량	<2.5mm	증가 :RAE
	전기축	탈분극진행방향	0 - 90'	비정상 적인 자극생성
PR 간격	간격	방실전도시간	120-200ms	단축 :조기홍분, 접합부율동 연장 :방실전도지연
QRS 파	폭	심실내전도시간	<120ms	증가 :각차단, 조기홍분, 심실박동, 인공심실조율 등
	크기	심실근량	<26mm	증가 :심실비후 감소 :심낭삼출
	전기축	탈분극진행방향	-30 - 90'	비정상 : 심실비후, 섬유속차단
ST 절	높이	완속재분극	< ±1mm	상승:심외막 허혈 하강:심내막 허혈
T 파	크기	후기급속 재분극	R 파의 1/8-1/3(<10mm)	상승 : 심근허혈, 고칼륨혈증 평탄,역위 :심근허혈
QT 간격	간격	심실 총 재분극 시간	<440ms	연장 : 저칼륨(칼슘)혈증, 심근허혈, 항부정맥제 단축 :고칼륨(칼슘)혈증
U 파	크기		T 파의 1/4	저명: 저칼륨혈증, 역위 :심근허혈

조정관, 심전도 홀로서기

심전도 분석 순서

1. Rhythm

- Rate
- Conduction
- Heart rate
- P wave morphology
- QRS morphology
- ST morphology

2. Compare with previous ECG

3. Conclusion

감사합니다