PASSION ACADEMIC TEAM

YU - MEDICINE

Cardiovascular System

Sheet#

Lec. Date :

Lec. Title : Part 3 Lec 3

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ELECTROCARDIOGRAPHY

Learning Objectives

On completion of study of this chapter, the student MUST be able to:

- Define ECG and list the uses of ECG.
- Classify ECG leads.
- Identify the ECG waves, segments and intervals.
- Define and give normal values and significance of various ECG waves, segments and intervals.
- Understand the concept of a cardiac dipole and how the different ECG waveforms are produced.
- Determine mean QRS axis, and list the common causes of left and right axis deviations.

RECORDING OF ECG

ECG is recorded in 12 leads, which are generally classified into two categories:

1-Coronal plane (limb leads)

- Bipolar leads (I,II,III)
- Unipolar limb leads (aVL, aVR, aVF)

2- Transverseplane

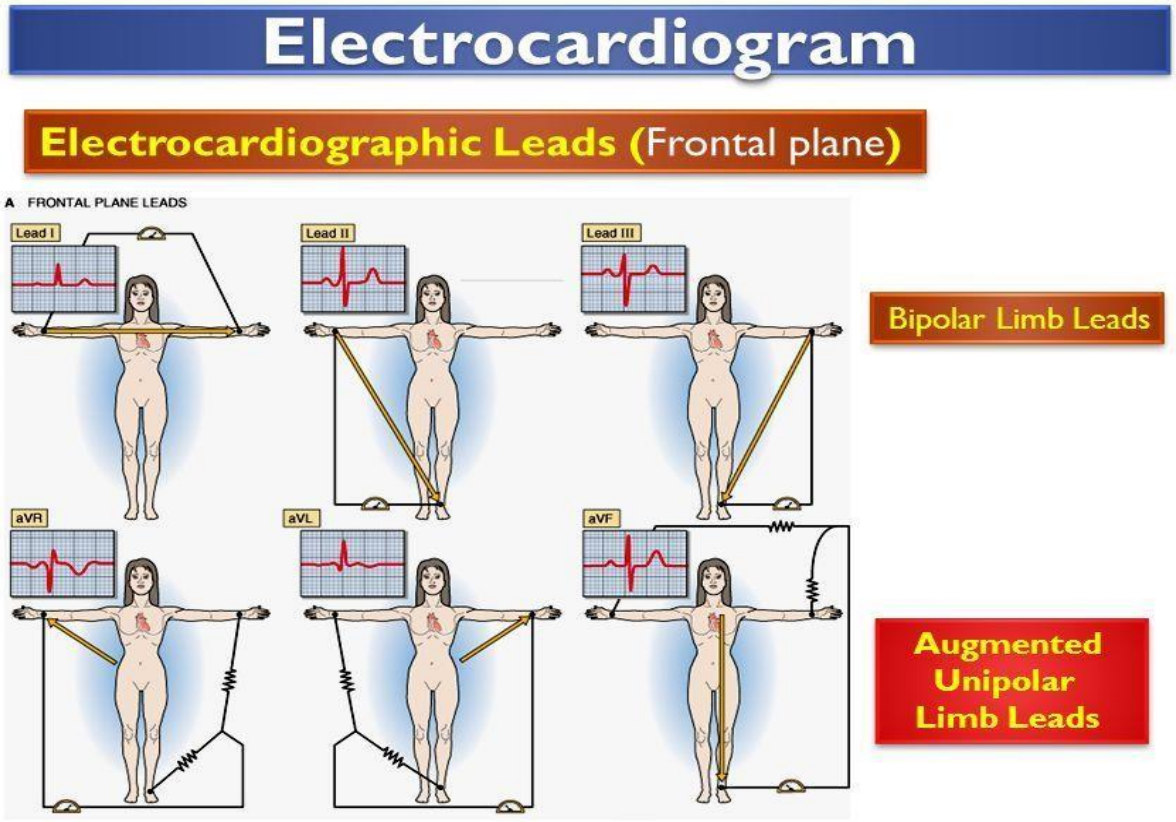
- Unipolar chest leads (V1-V6)

Lead	+	-
I	LA	RA
II	LL	RA
III	LL	LA

Standard bipolar limb lead ECG configuration.

Lead	POSITIVE INPUT	NEGATIVE INPUT
aVR	Right arm	Left arm + left leg
aVL	Left arm	Right arm + left leg
aVF	Left leg	Left arm + left arm

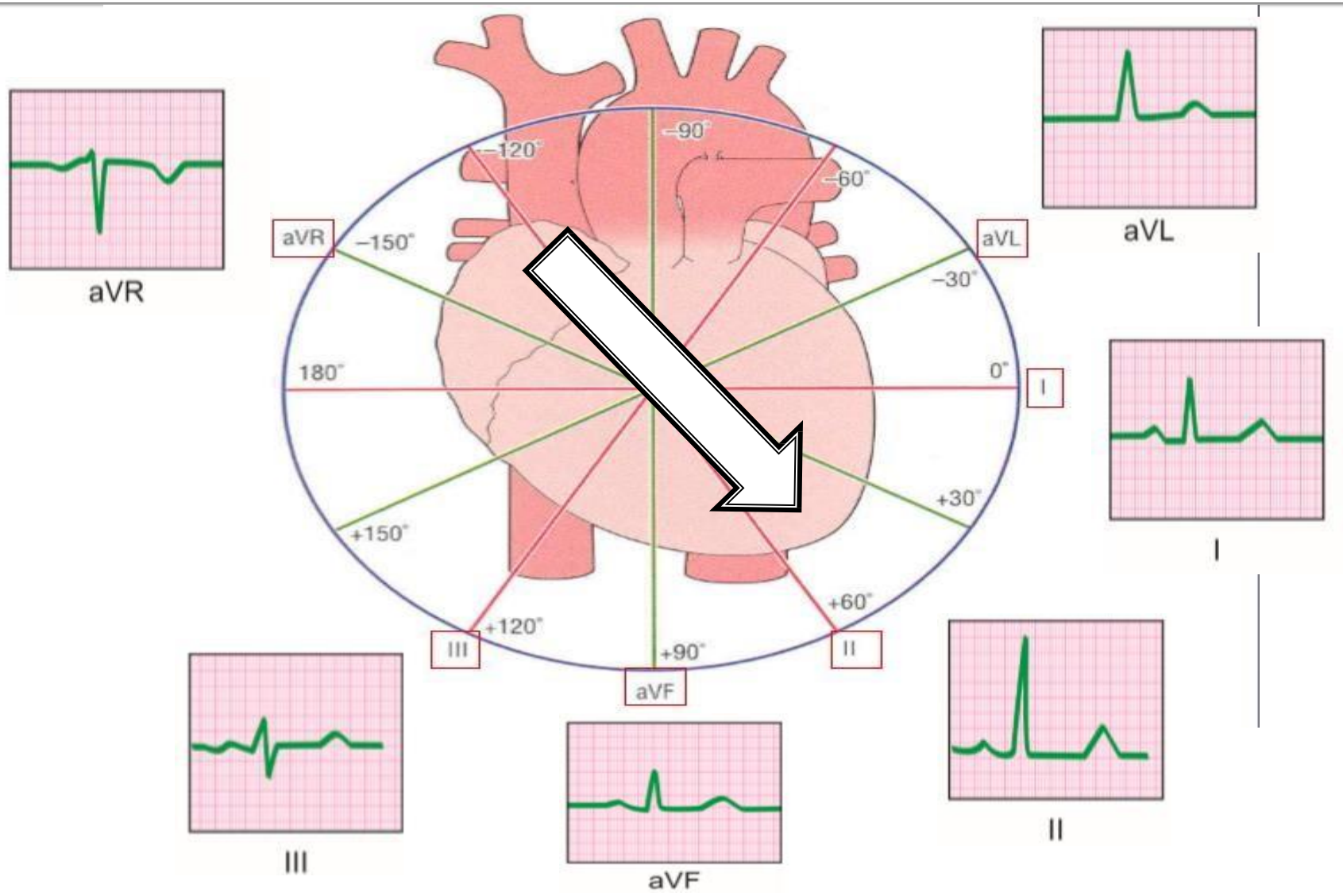
AUGMENTED UNIPOLAR LIMB LEADS



In unipolar leads, one electrode is an active or the exploring electrode (+v pole) and the other is an indifferent electrode (-v pole) atzero potential.

*Lead: is a serise of electrodes on the surface of the body that connected to the ECG machine for measuring the potential between only 2 points.
*Limb leads are 6 windows , look to the heart at frontal plane,
*Chest unipolar lead: look to the heart at horizontal plane
*first table :
Lead 1 : connection between the left and right arm
Lead 2 : connection between the left leg and right arm
Lead 3 : connection between left leg and left arm
*All give the normal ECG pattern
Also we have aVL , aVF , aVR (معكوس بس طبيعي)

Axial reference system



Limb leads form an imaginary circle around the heart.

بنصور القلب من جميع الاتجاهات عشان هيك عنا اكتر من limb

*These leads divide the circle into equal 30° segments.

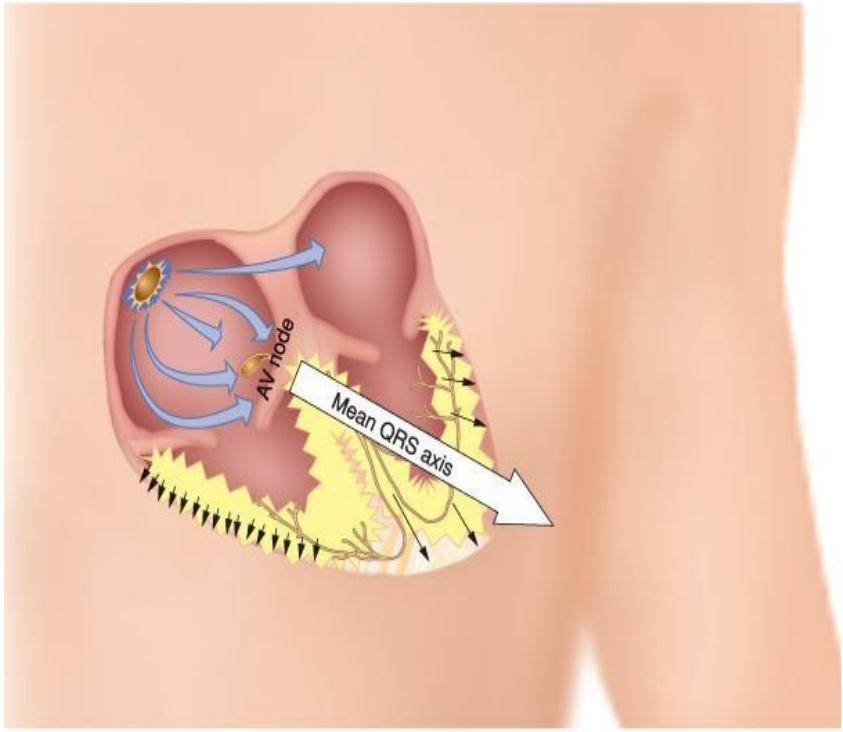
The MEA is downward to the left with 60° , exactly at lead 2

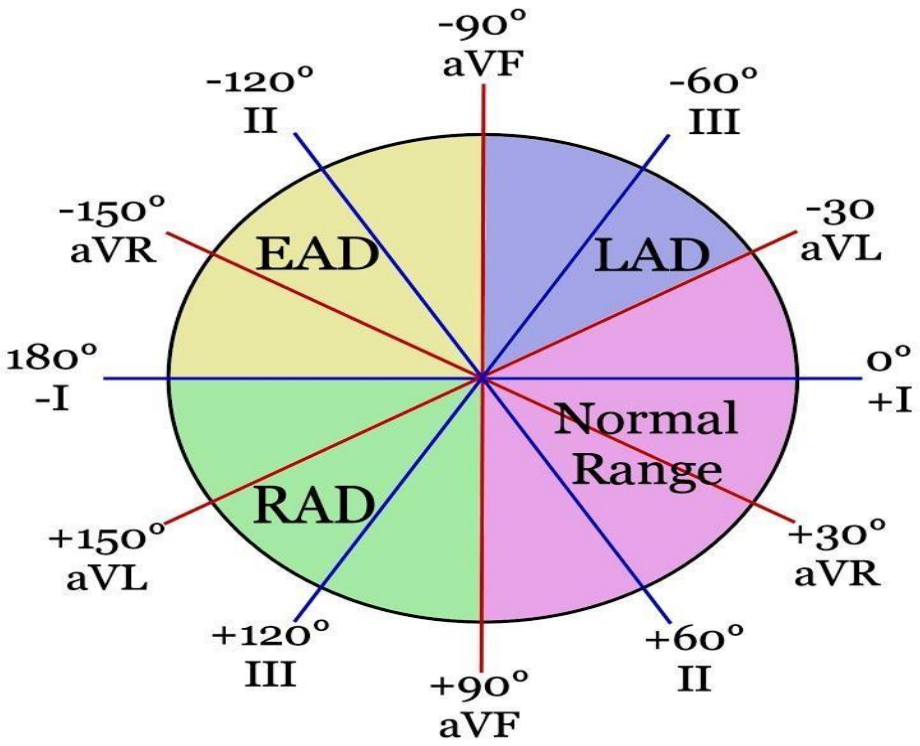
*Lead 1 : the positive electrode is the left arm, it’s said to be 0 degree .

*Leads 1,3,avl,avf : positive upward deflection. The MEA more toward them in different angels.

*avr : اتفقنا انه طبيعي ولكن معكوس تماما

Mean electrical axis of the ventricles





- EAD: extreme axis deviation
- LAD: left axis deviation
- RAD: right axis deviation

*MEA of the normal range is directed downward and to the left between (-30°→110°)

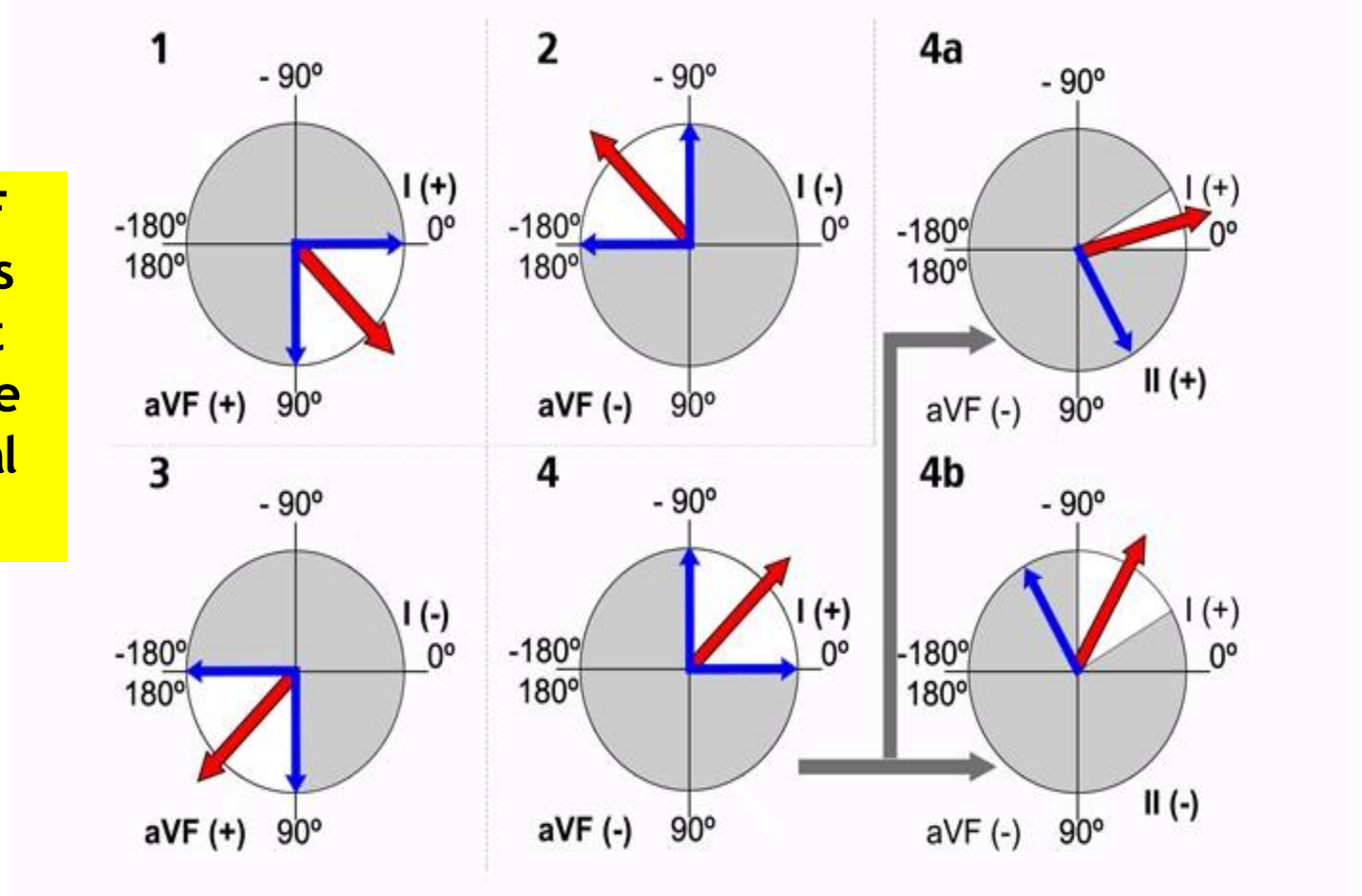
*If it is between (-30° → -90°) → left axis deviation.

*If it is between (-90° → 180°) → extreme axis deviation.

*If it is between (110°→ 180°) → right axis deviation.

Determination of the electrical axis of heart by using lead I and aVF

Use leads I and aVF
These two leads can best detect variations in the heart's electrical axis



To determine the electrical axis of the heart we use lead 1 + avf .

*If the QRS in lead 1 and avf is positive , drow an arrow toward the positive electrode of lead I (left arm →) and another arrow toward the positive electrode of avf (left leg↓),,, so the average will be between them(↘) (0°→ 90°) 1 الرسمة رقم

افهموها هون لانه الباقي ع نفس النمط,,,

*If the QRS is negative to lead 1 (the first arrow will be opposite to left arm (←)) , also it is negative to avf (the second arrow will be opposite to the left leg (↑)) , the avarage will be between them (↖). 2 الرسمة

* If the QRS is negative to lead 1 (the first arrow will be opposite to left arm (←)) , and positive to avf (the second arrow will be toward the left leg (↓) < , the avarage will be between them (↙). 3 الرسمة

*If the QRS is positive to lead 1 (the first arrow will be toward left arm (→)) , and it is negative to avf (the second arrow will be opposite to the left leg (↑)) , the avarage will be between them (↗). هاد الحكي بالرسمة 4 بس هون صار عندي مشكلة انه السهم طله بالربع الاول وزي ما اتفقنا بالسلايد الفات انه الربع الاول كان فيه ثلث نورمال وثلث كان ليفت ديفياشن , فكيف بدي اعرف هل الوضع طبيعي ولا في مشكله والسهم لوين مايل اكتر !!! ↓↓↓

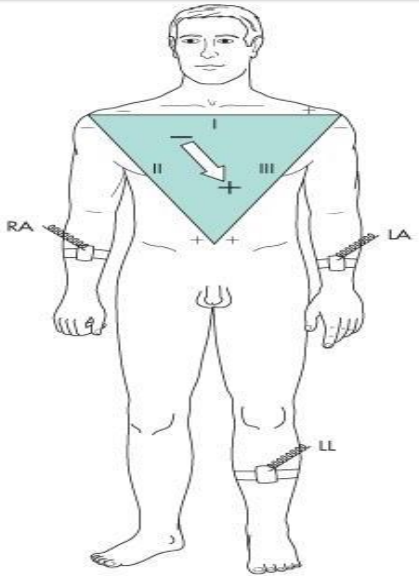
•To solve this problem we want to see lead 2 :

•1- lead 2 positive → the average arrow will be close to 0° so it is normal, احسبها بنفس الطريقة.

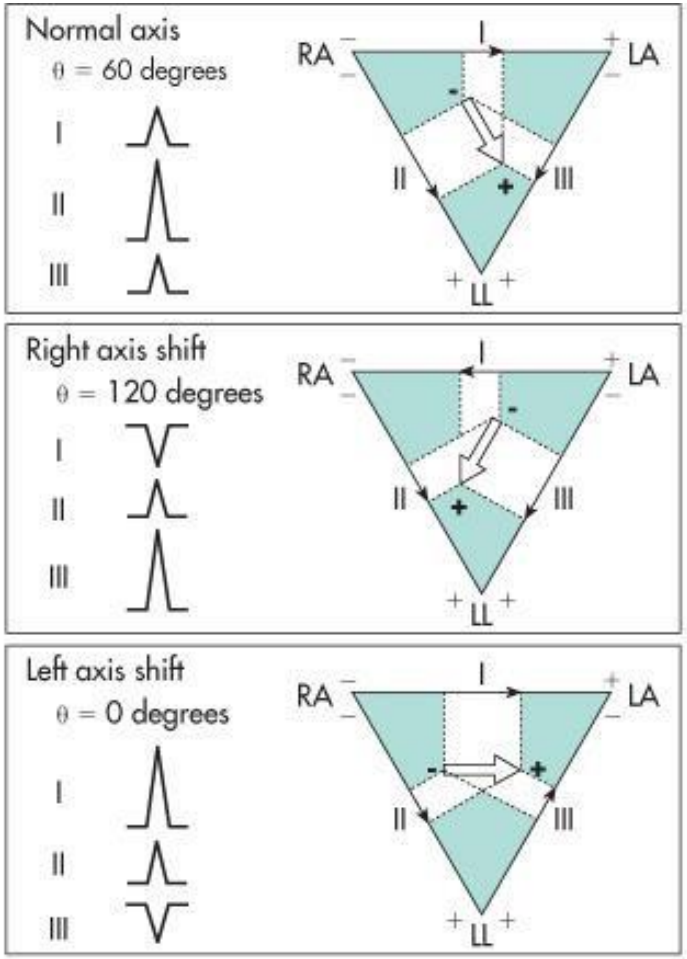
•2- lead 2 negative→ the average arrow will be closer to -90° so it is LAD.

Determination of the electrical axis of heart

- The axis can be thought of as the overall direction of the cardiac impulse or wave of depolarization of the heart (60 degree)
- An abnormal axis (axis deviation) can give a clue to possible pathology



A



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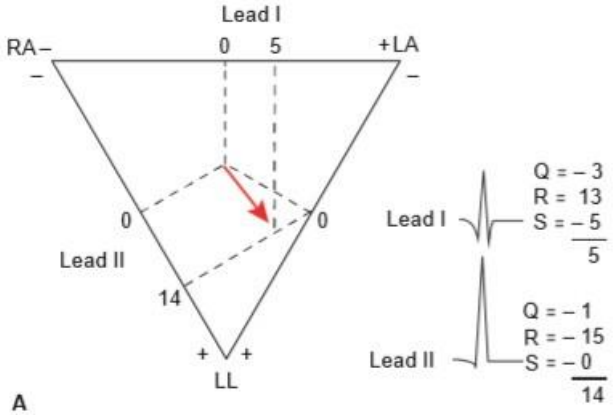

A

*triangular It surrounds the heart and consists of lead 1,2,3.
*we have to determine R wave hight with 2 of the 3 leads, then it is platted at the side of the lead.

- If R value is negative → the arrow will toward the negative electrode.
- If R value is positive→ the arrow will toward the positive electrode.

الان نزل خطوط من الضلعين واعرف النتيجة.

Unipolar chest leads(Precordial leads)

Chest leads

Lead V1: In the right fourth intercostal space, just near the sternum.

Lead V2: In the left fourth intercostal space, just near the sternum.

Lead V3: Halfway between V2 and V4.

Lead V4: In the left fifth intercostal space at mid-clavicular line.

Lead V5: In the left fifth intercostal space at anterior axillary line.

Lead V6: In the left fifth intercostal space at mid-axillary line.