

MASTERING AUGMENTED UNIPOLAR LIMB LEADS

Dr. Najeeb Lecture notes

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KGMC

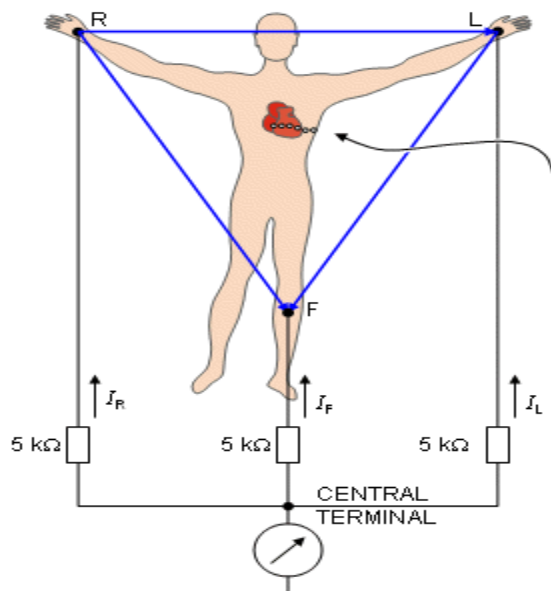
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Unipolar limb leads are modified bipolar leads. Positive terminal is attached to positive electrode. The negative terminal in unipolar leads have been modified through multiple connections and resistances (of 5000 ohm) into **indifferent electrode**, also called near zero electrode, null electrode or virtual electrode.

WILSON CENTRAL TERMINAL

An artificially constructed reference for ECG, which is assumed to be near zero and steady during cardiac cycle; namely it is the simple average of the three recorded limbs (right arm, left arm and left leg) composing the Einthoven triangle and considered to be electrically equidistant from the electrical center of the heart.

Wilson central terminal is formed by connecting the three extremities through 5000 ohm resistors to central point.



How Wilson central terminal is achieved?

- Negative terminals attached to right arm, left arm and foot
- By these negative terminals, an indifferent electrode is achieved at the center of the heart
- V_F - Positive electrode on left foot
- V_R – Positive electrode on right arm
- V_L – Positive electrode on left arm

Whenever positive electrode is exploring voltage relative to indifferent electrode in the body, the lead is called V lead.

Drawback of Wilson Central Terminal:

- The voltages recorded are very small

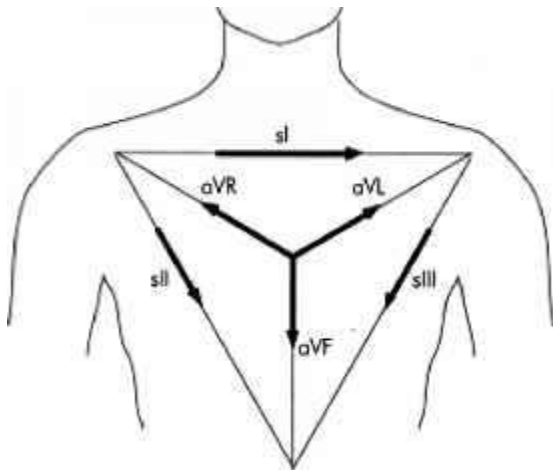
Reason behind the small voltage:

1. When Positive electrode is referenced against indifferent electrode, voltage drops
2. The negative and positive electrodes are placed at the same place so the effect of both cancel each other and becomes the cause of reduced potential

Solution for this drawback:

- Modify Wilson Central terminal in such a way that wherever positive electrode is placed, at the same place negative electrode should be inactivated so voltage can be amplified

AXIS OF UNIPOLAR LIMB LEADS



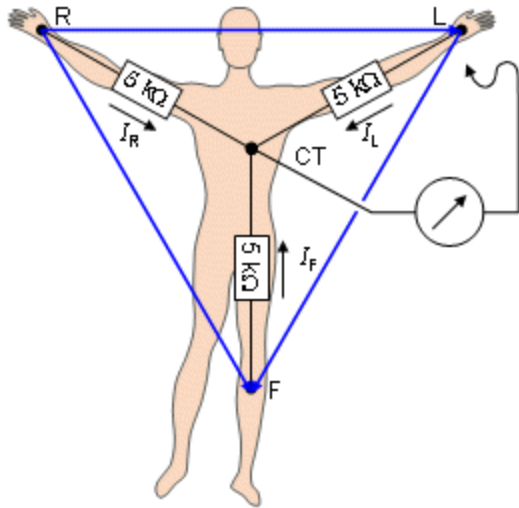
GOLDBERG'S CENTRAL TERMINAL

Goldberg modified the Wilson central terminal. Wherever positive electrode is placed, associated negative electrode from that point was disconnected. Due to this disconnection, the Wilson's central terminal shifts to Goldberg's central terminal and the voltage is 50% amplified or augmented. The amplified voltages are called augmented voltages i.e. aV_F , aV_R , aV_L

The Wilson leads are no more used for limbs. These leads are used for chest.

Wilson's indifferent electrode is fixed while Goldberg's indifferent electrode is variable.

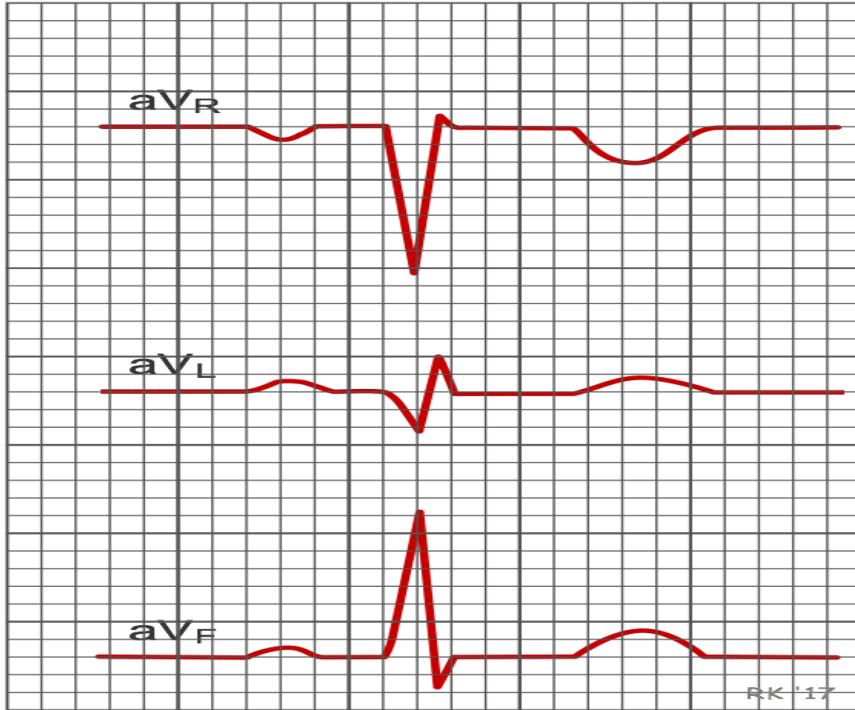
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PATTERNS OF UNIPOLAR LIMB LEADS

- Pattern of aV_F - Mainly positive deflection. Deflection of aV_F is smaller than lead II and slightly larger than lead III
- Pattern of aV_L - Deflection is mainly positive and is almost same as lead I
- Pattern of aV_R - deflection is reversed i.e. mainly negative deflection

$$aV_F + aV_R + aV_L = 0$$

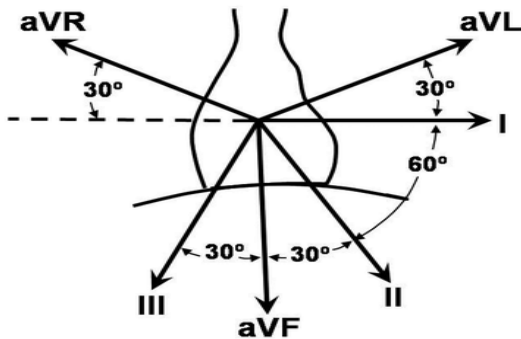


TRIAxIAL REFERENCE

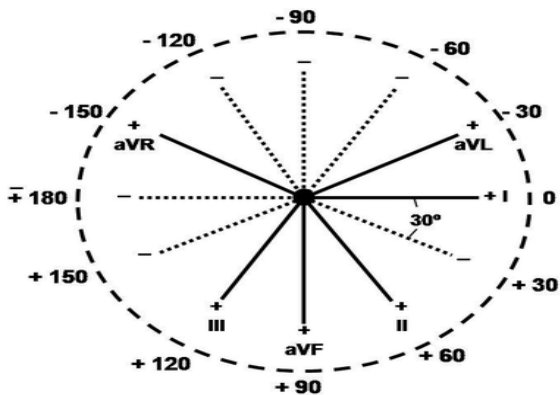
The triaxial orientation refers to the leads angulated in reference to each other.

HEXAXIAL ORIENTATION

Orientation of bipolar and unipolar leads angulated in reference to each other. Significance of hexaxial orientation is to determine electrical axis of the heart.



Triaxial Reference System



Hexaxial Reference System