Differential Diagnosis of THE Electrocardiogram, by Sidney R. Arbeit, M.D., Ira L. Rubin, M.D., Harry Gross, M.d. 1st. Edition, 1960. F.A. Davis Company, Publisher, Philadelphia, PA

Chapter 1, pgs 3 thru 15, Tutorial – Electrophysiology of the Normal Heart

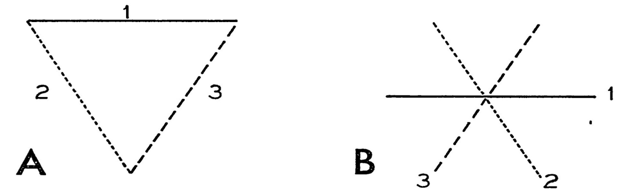

FIGURE 16. A, Einthoven triangle formed by standard leads 1, 2 and 3. B, Triaxial reference system of Bayley formed by the displacement of the three sides of the Einthoven triangle so that they cross at a single, central point.

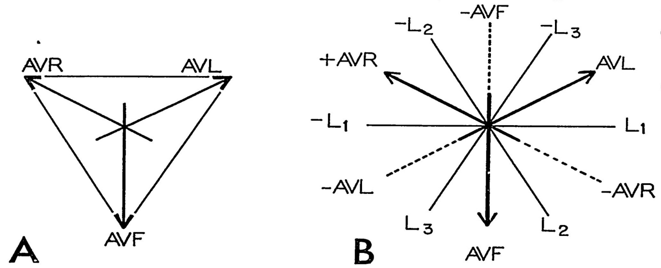

FIGURE 17. A, The unipolar limb leads are shown arising from a single point in the center of the Einthoven triangle. B, The unipolar limb leads are superimposed on the Bayley triaxial system to form a hexaxial reference system.

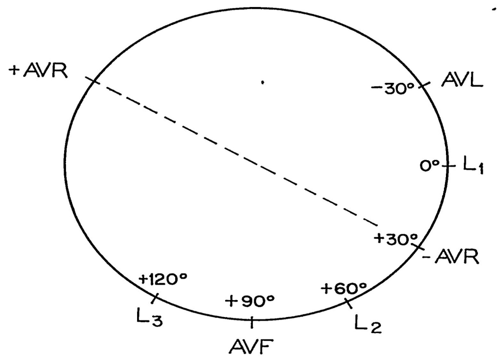

FIGURE 18. The projection of the hexaxial reference system onto a circle. The radiating spokes are removed. The angular relationship between the various frontal plane leads is indicated in the diagram. The dotted line indicates the relationship of +AVR to −AVR, its mirror image.

CLINICAL RECORDING OF THE ELECTROMOTIVE FORCE OF THE HEART IN THE HORIZONTAL PLANE (PRECORDIAL LEADS V_1 TO V_6)

Additional information may be derived as to the nature of the internal electromotive forces in the heart by taking the precordial or V leads. These record information in a horizontal plane through the body at about the level of the fourth or fifth intercostal space.

These leads are constructed as follows: The indifferent or negative electrode is the Wilson Central Terminal, as described previously. The exploring electrode attached to the positive pole of the electrocardiograph is moved successively through a series of arbitrarily fixed positions on the chest, the V leads (Figs. 19 and 20). (See p. 17 for the exact location of the precordial lead positions.)

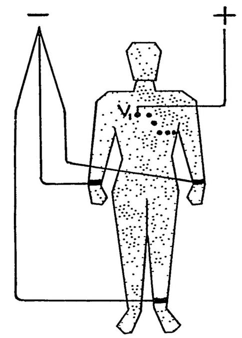

FIGURE 19. Electrical connections for taking the precordial V leads.

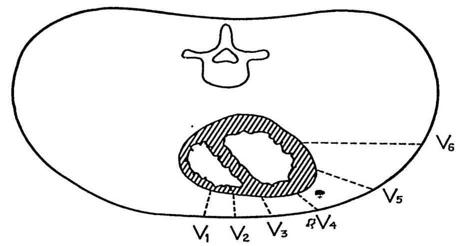

FIGURE 20. Diagrammatic relationship of the V leads to the heart.

We now have a frame of reference for recording the voltage generated by the heart, a source of electromotive force, in the living body, a presumed homogeneous volume conductor. The clinical electrocardiographic leads are arranged around the periphery of the volume conductor. As voltages are generated in the heart, they may be measured at these various lead points. The form and amplitude of the internal voltage may be visualized from these measured voltages.

DERIVATION OF THE MEAN ELECTRICAL AXIS OF THE ELECTROMOTIVE FORCE OF THE HEART

In the intact heart the instantaneous vector of depolarization changes continuously in both amplitude and direction. The vectorial sum of all the instantaneous electrical forces occurring during depolarization, the QRS, is the mean electrical axis (MEA) of QRS.

The electrode toward which the vector points will record the maximum positive voltage, while that away from which the vector points will record the maximum negative voltage. A plane at right angles to the mean vector defines the zone of zero voltage, the null point or transitional zone of that instantaneous vector (Fig. 21). At this point the positive and negative voltages are equal. The resultant complex can be either a straight line or a diphasic curve whose total positive and negative voltages equal each other.

For investigational purposes the exact measurement of the area under the wave is indispensable. For clinical purposes, however, simple inspection