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Influence on the Electrocardiogram of Changing Electrical Axis from Anterior to Posterior Mediastinum.

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The influence of position of the heart on the electrocardiogram has in recent years received considerable attention. That position of the electrical axis may be of importance was first emphasized by Lewis,[3] and the subsequent experiments of Katz and Barker[1, 2] have indicated the importance of a more detailed study of the subject.

Kountz[4] has shown that placing hearts of dogs within the human pericardial cavity yield curves of a similar nature to those obtained in man. This is especially true when the dog heart has the same interthoracic relationship as that of man. Changing the position of the electrical axis will greatly influence the electrocardiographic curves. This observer has further shown that the dog's heart, readily movable from anterior to posterior mediastinum, yields markedly dissimilar curves when the position of the heart is altered anteriorly or posteriorly. These experiments have served to emphasize the importance of further investigation along these lines.

A dog heart-lung preparation was set up (Starling), and the heart and lungs removed from its body; the thorax of a cadaver, recently dead was opened anteriorly. The esophagus of the heart-lung preparation was connected by a wire to an electrode, which could be placed in any part of the human thorax. One chest electrode was placed in the left anterior chest wall; another in the right posterior wall, care being taken that these electrodes were equidistant from the midline of the chest. There were thus formed 2 vectors, one lying anteriorly, and the other posteriorly. The apex of the heart-lung preparation was connected to the esophagus in the chest. Finally, the 3 leads of the electrocardiograph were connected to the arms and left leg of the cadaver, by embedding the electrodes in the muscles. By this arrangement it was found that a cardio-

1 Katz, L. N., and Ackerman, W., *J. Clin. Invest.*, 1932, **11**, 12.

2 Barker, P. S., MacLeod, A. G., and Alexander, J., *Am. Heart J.*, 1930, **5**, 720.

3 Lewis, T., *Mechanism and Graphic Registration of the Heart Beat*, London, 3d edition, 1925.

4 Kountz, W. B., to be published.

electric impulse arising in the heart-lung preparation was reflected in the electrocardiograms obtained from the cadaver (the heart-lung preparation being outside the human body), and that, by changing the chest electrode in contact, the different vectors, representing electrical axes, could be obtained.

With the chest electrode in the left anterior chest, extrasystoles were produced by stimulation of the lateral wall of the left ventricle of the heart-lung preparation. The extrasystole curves thus produced were down in lead 1, and up in lead 3. Stimulation of the lateral wall of the right ventricle of the heart-lung preparation resulted in the opposite, with extrasystole complexes upward in lead 1 and downward in lead 3. These results were similar to those obtained by Barker[2] in man.

With the chest electrode in the right posterior chest, extrasystoles arising in the lateral wall of the left ventricle of the heart-lung preparation yielded curves upward in lead 1 and downward in lead 3; those arising in the lateral wall of the right ventricle of the heart preparation gave complexes downward in lead 1 and upward in lead 3. The results here were similar to those obtained by Lewis in the dog. It is seen that here there is a complete reversal of curves, as when the chest electrode was in the left anterior chest.

Since the chest electrodes formed identical angles with the midline of the body, though one was anteriorly and the other posteriorly placed, one might have expected the same type of electrocardiogram with the chest electrodes in the anterior or posterior chest. This, however, was not found. It would seem, therefore, that the factor of contact and electrical resistance of tissue, besides position of the electrical axis, would be an important influence in determining the type of electrocardiographic curve of extrasystoles arising in the heart.