Interesting Electrocardiogram

The Electrocardiogram in Atrial Enlargement

M. Irené Ferrer, M.D.
Consultant in Cardiology Metropolitan Life Insurance Company
Professor Emeritus of Clinical Medicine, College of Physicians and Surgeons, Columbia University
Consultant Electrocardiographer, Presbyterian Hospital, Columbia Presbyterian Medical Center, New York, N.Y.

The two tracings shown here illustrate a real problem in electrocardiography, — namely the interpretation of atrial enlargement from P wave changes. The first tracing (#1) meets the criteria for right atrial enlargement in that the P wave amplitude in lead II (measuring from the PR segment, i.e., just before the R wave rises) is more than 0.30 millivolts or 3 small boxes. The second tracing (#2) meets criteria for left atrial enlargement by showing a deeply negative P wave, more negative than −0.15 millivolts or 1.5 small boxes, in V1 and the negative part of the P wave in this same lead (V1) greater than 0.04 second in duration. Normally the P wave is diphasic in V1 and is not all negative as seen in tracing #2.

The value of P wave analysis in the discovery of atrial enlargement is definitely limited but has been used quite commonly. With today’s cardiology diagnostic tools, however, notably echocardiograms, the clinical non-invasive definition of atrial enlargement no longer depends on the ECG. These two cases illustrate the real difficulties one faces in reading atrial enlargement from the ECG.

The first tracing was taken on an 88-year-old female admitted for possible intestinal obstruction. She had angina and was on inderal. Note that the tracing shows left ventricular hypertrophy with strain (by QRS voltage and ST-T criteria). There is no evidence, or reason for, right atrial enlargement. Furthermore, the diaphragm was elevated by the abdominal swelling which conceivably could cause cardiac elevation and rotation of the right atrium. This rotation can increase the P voltage as seen here.

The second tracing was taken on a 53-year-old female admitted for a GI bleed who had had a bilateral mastectomy. The latter means the V leads are taken through a very thin layer of anterior chest tissue which of course may change the registration of atrial waves.

It is clear that given the presence of the ECG criteria for right or left atrial enlargement, one should get some additional information before accepting the ECG evidence as diagnostic for atrial enlargement. There are two other features of the P wave which can be mentioned as possibly helpful. It is rather common to have a wide P wave (intra-atrial block) associated with true left atrial enlargement. A wide P is almost never seen in right atrial enlargement. The mean frontal plane electrical axis of the P wave, even in the presence of left or right atrial enlargement, is usually located within the normal limits of +90° and −60°. This is because atrial enlargement alters the mean electrical axis more in the horizontal plane than in the frontal plane. Hence, left enlargement tends to shift P axis leftward and right enlargement rightward but the overall change in frontal plane axis is not great and only serial measurement of P axis would be of use.