Late Systolic Apical Impulses: The Role of Atrial Contraction in Their Genesis*

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The apexcardiogram provides useful information regarding left ventricular function and contractility in experimental animals and human subjects. Left ventricular systolic pressure, end-diastolic pressure, stroke volume, afterload and local alterations of myocardial contraction all influence the contour of the left ventricular impulse as recorded by the apexcardiogram. Recently, we observed the intermittent appearance of late systolic bulges on the apexcardiograms of subjects with coronary artery disease, complete heart block and left ventricular dyskinesis. We present here the apex recording from such a patient.

Figure 1 shows the apexcardiogram and lead 2 of the electrocardiogram recorded from an 82-year-old man with coronary artery disease, congestive heart failure, a transvenous right ventricular pacemaker and intermittent apical abnormalities noted on palpation. An irregular sinus bradycardia at 52 beats/minute can be identified on the electrocardiogram. Pacemaker-induced ventricular depolarizations are occurring at a rate of 60/minute. Note that systolic apex impulses numbered 3, 6, and 10 are preceded by P waves at P-R intervals of 0.28, 0.40 and 0.18 second. Small late systolic "bulges" can be identified in apex impulses numbered 3 and 6. Apex impulse number 10 is associated with the most physiologic P-R interval (0.18 second). Observe the prominent "a" wave and sharply inscribed late systolic bulge (SB) produced by this latter contraction. Systolic waves without late "bulges" are preceded by longer P-R intervals.

The intermittent late systolic waves seen in this patient can be ascribed to a local abnormality of myocardial contraction accentuated by properly timed atrial systoles. At optimal P-R intervals, atrial contraction significantly elevated left ventricular end-diastolic tension and fiber length. Beat-to-beat alteration of left ventricular preload resulting from atrial contraction acted as a provocative measure which at times induced both palpable and recordable left ventricular dyskinesis.

In conclusion, the apexcardiogram offers a method for graphically displaying local areas of abnormal left ventricular contraction occurring intermittently during complete heart block.
REFERENCES
5 Benchimol A: Significance of the contribution of atrial systole to cardiac function in man. Am J Cardiol 23:588-571, 1969

Forest Trees and Their Invisible and Indispensable Partners

Most forest trees seem to depend for a major part of their nourishment upon fungi on their absorbing roots. This partnership between tree and fungus apparently is an ancient one, and the ancient progenitors of our present conifers, such as pines, spruces, and firs, also had mycorrhizal roots and depended for their nourishment upon a fungus on their absorbing roots. Several different fungi may form mycorrhizas with absorbing roots of a given species of tree, and a given species of fungus may form mycorrhizas with several species of trees. Wherever the tree seedlings arise in soil that does not contain a well-rounded diet for them, mycorrhizal fungi may be essential for their growth and survival. Even when a tree is growing in a rich soil, as few forest trees do, the mycorrhizal fungi may aid them. In general, about 90 percent of the absorbing roots of a conifer tree are likely to be mycorrhizal, without root hairs, and surrounded by a mantle of fungus mycelium. It has been possible in practice to boost the growth of forest tree seedlings by inoculating the seed beds with mycorrhizal fungi. This has been especially true when the seedlings were raised in areas where no such trees occurred naturally.