ELECTROCARDIOGRAM OF THE MONTH

Retrograde Conduction in Complete Heart Block

The author would be pleased to receive comment and controversy from readers in relation to explanations offered.

This electrocardiogram (Lead II) shows a complete A-V block. The patient had coronary sclerosis without any history of myocardial infarction. Although casual inspection might suggest only 3:1 block, closer study will reveal that the P-R interval gradually lengthens, clearly indicating that total dissociation between atria and ventricles must exist. Furthermore, a ventricular extrasystole appears and it should be noted that the post-extrasystolic pause is as long as the pause between two automatic beats. This proves the presence of complete A-V block. That is, the extrasystole “breaks into” the automatic center on its spread over the ventricles and depolarizes it completely so that impulse formation must begin anew. It is only in complete heart block, when an extrasystole can reach the automatic center, that the post-extrasystolic pause is equal to an automatic period.

The inverted P waves between the QRS and T of the extrasystole and of the first post-extrasystolic automatic beat are also of considerable interest. Such pointed, deeply inverted P waves in Lead II strongly suggest that both the extrasystole and the following automatic beat are conducted in a retrograde direction to the atria. In recent years, study of ventricular extrasystoles in humans has revealed that this occurs much more frequently than previously considered possible. In this patient it is of further interest to find that a ventricular extrasystole and an automatic beat can be conducted in a retrograde direction while there is complete blocking of conduction in the orthograde direction. This situation is all the more remarkable since the retrograde conduction occurs so rapidly; the R-P interval of the extrasystole is only 0.12 second, a short time indeed for conduction in the normal direction. Naturally, an atrial premature contraction arises as a result of the retrograde conduction. If tracings of A-V block are studied carefully, V-A conduction is found not at all infrequently.

The mechanism of such events is unknown. Several theories have been offered. Unidirectional block was assumed to exist; an impulse could travel in one direction but not the other. Activity in a supernormal phase of conductivity was postulated but this idea has little supporting evidence. It has been suggested that the mechanical stimulus derived from the contraction of the ventricle might stimulate an A-V nodal center and induce impulse formation there. We consider it more probable that the activation of the ventricles produces a spread of electrotonic potential beyond the block area as demonstrated with nerve block by Hodgkin, and thus activates the atria. The electrotonic potential created by the activation of the atria is too weak to be able to activate the ventricles beyond the block.

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