第1日・10月3日〈金〉 13:00~14:00 第1会場

New insights into atrio-ventricular and ventriculo-atrial conduction

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The advent of radiofrequency catheter ablation to terminate A-V nodal reentrant tachycardia (AVNRT) has been a revolutionary advance in the clinical treatment of one of many types of cardiac arrhythmias. From a basic science standpoint, prevailing views regarding antegrade (A-V) and retrograde (V-A) conduction have been found to be seriously deficient and there is, therefore, a need for new concepts to be developed based on a better understanding of the structure and physiology of the A-V junction.

METHODS

We have studied A-V and V-A conduction in the dog heart, *in vivo*, the superfused rabbit A-V junction, *in vitro*, and the Langendorff perfused dog heart, *ex vivo*. Electrograms were recorded from the posterior, mid and anterior aspects of the triangle of Koch as well as a reference His bundle electrogram at the apex of the triangle. Atrial pacing was performed from fixed electrodes in the high right atrium and retrograde conduction was evaluated during pacing from the right ventricle or His bundle. In many of the experiments transmembrane action potentials were recorded to identify the specific cellular subtypes of the various junctional tissues and correlate their action potential characteristics with their extracellular electrograms. Radiofrequency catheter ablation or discrete surgical incisions were used to eliminate or segregate anterior, mid or posterior A-V nodal inputs in order to further characterize their individual and combined contributions to A-V nodal function, i.e., A-V and V-A conduction.

RESULTS

In the anesthetized dog, at a fixed atrial pacing rate, ablation of the fast pathway A-V nodal inputs, using clinical criteria, resulted in a significantly prolonged A-H interval and a shift of the earliest site of retrograde atrial activation from the anterior to posterior regions of the triangle of Koch. Antegrade activation sequence was not generally altered. Similarly, selective ablation of the slow pathway input to the A-V node significantly prolonged the Wenckebach cycle length with no change in A-H interval at a given paced rate. In addition, we found that even after combined fast/slow or slow/fast A-V nodal input ablations complete A-V block was observed only in 1 of 8 dogs whereas complete or high grade V-A block was seen in 50-75% of cases. In another series, a linear lesion across the interatrial septum in addition to fast pathway ablation produced a consistent shift of antegrade

activation so that the posterior A-V nodal input was activated prior to the anterior input. Subsequent slow pathway ablation now produced complete A-V and V-A block. Histologic studies in all cases showed selective ablative lesions in the transitional tissues of the anterior and posterior inputs and adjacent atrium but the compact A-V node and His bundle were undamaged. In some cases incremental pacing distal to the block site showed 1:1 A-H conduction, Wenckebach block and 2:1 A-H block.

The studies in the rabbit and the Langendorff perfused dog heart, *ex vivo*, allowed the cellular electrophysiologic characterization of the transitional cells comprising the posterior, middle and anterior A-V nodal inputs. Only the posterior (slow) or mid pathway showed Wenckebach block, although at significantly different cycle lengths ; whereas the anterior (fast) pathway, at much shorter cycle lengths only exhibited 2:1 atrial/fast pathway conduction patterns. Differences in automaticity and excitability were also found to be distinctive for the various transitional cell subtypes making up the slow and fast A-V nodal inputs.

CONCLUSIONS

These studies suggest that the antegrade atrial conduction system consists of multiple transitional zone inputs serving as a large source entering the compact A-V node, i.e., a small sink ; whereas retrograde conduction is necessarily weaker due to the small source, i.e., His bundle signal, degraded as it passes through the poorly coupled compact A-V node, having to depolarize a large sink, the atrial musculature. The transitional tissue play an important role as determinants of successful A-V and V-A conduction since they are interposed between atrium and the compact A-V node and His bundle.