Characterization of onset mechanism and waveform analysis in patients with atrial fibrillation using a high-resolution noncontact mapping system.

INTRODUCTION: Information on the spatiotemporal organization of atrial activity at the onset of atrial fibrillation (AF) is limited. METHODS AND RESULTS: The study consisted of 26 consecutive patients (22 men and 4 women; mean age 56 +/- 9 years) with AF in whom the left atrium (LA) was mapped using a noncontact mapping system. At the onset of AF, the AF cycle lengths and wavefronts were analyzed at the site of origin of the triggering atrial premature complex (APC) and five predefined sites within the LA (superior, anterior, posterior, lateral, and septal walls). If repetitive activity was observed at the site of origin of APCs, triggered AF episodes were considered as focally driven. APCs that induced AF had shorter coupling intervals than APCs that did not induce AF (300 +/- 41 msec vs 392 +/- 64 msec, P< 0.001). Immediately after AF onset, repetitive firing was crucial for maintenance of arrhythmia in 52 (80%) of 65 AF episodes. In 13 AF onset episodes (20%), AF was maintained by other mechanisms. The number of LA wavefronts after AF onset was lower in focally driven AF episodes compared with episodes in which no focally driven activity was observed (1.9 +/- 0.6 v. 2.3 +/- 2.3 wavefronts, P< 0.05). After the onset of AF, the posterior wall of the LA showed the earliest disorganized activity (after 5.2 +/- 3.1 cycles). CONCLUSION: In the...
majority of AF episodes (80%), repetitive firing from the triggering foci may play an important role in maintaining AF immediately after arrhythmia onset. In 20% of the episodes, AF at early stages seems to be maintained by other mechanisms. The capability of APCs to induce AF depends on the coupling interval and the focus localization. The posterior wall of the LA shows the earliest disorganization of wavefronts at the onset of AF.