Electrophysiological Parameters and Anatomic Findings of Left Bundle Branch Pacing in an in vivo Canine Model

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Introduction: Left bundle branch pacing (LBBP), an alternative to His bundle pacing (HBP), could maintain the electrical synchrony of the left ventricle in a low and stable threshold. However, the definitions of LBBP have not been well established.

Methods: A canine model (n=3; male; weight 30-40 kg) was subjected to receive HBP and LBBP procedure. The characteristics of the electrocardiogram (ECG) and intracardiac electrogram (EGM) and the pacing parameters between HBP and LBBP were collected and compared. The hearts were isolated and stained by Lugol's iodine (5%) to show the relative locations between the leads and the conduction system.

Result: The means of potential to ventricle (PV) interval in HBP was significantly different to that in LBBP (26.67±3.06 vs. 12.67±1.15, P=0.002). The pacing parameters including pacing threshold, R wave amplitude and impedance were significantly different in HBP as compared to those in LBBP, respectively (2.30±0.66 vs. 0.67±0.15, P=0.014; 2.67±0.42 vs. 11.33±3.06, P=0.008; 423.3±40.4 vs. 660.0±45.8, P<0.0001). The paced morphology of ECG was the same as the intrinsic in HBP while it was a RBBB pattern in LBBP. The anatomic findings showed that the HBP lead was located at the right septum across the tricuspid and the LBBP lead was placed deeply and vertically with the ring of the lead inside the septum. The means of the lead depth were significantly different between HBP lead and LBBP lead (1.83±0.29 mm vs. 12.33±1.53 mm, P<0.0001). While from the left septum, the LBB and Purkinje network were stained dark brown and the tip of the LBBP lead's helix could be seen around the left bundle branch (LBB).

Conclusion: In this small size in vivo canine model study, HBP and LBBP could be performed feasibly and their characteristics could be summarized as: 1) with His and LBB potentials; 2) a RBBB paced morphology in LBBP; and 3) pacing parameters significantly different between HBP and LBBP. Moreover, the precise anatomic findings were direct evidences of the depth and the location of the leads around the conduction system.