# Conduction System Pacing Placement for Defibrillation Leads Reveals Unexpected Optimal Location in Implantable Cardioverter Defibrillator Simulations

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**Introduction:** Conduction system pacing (CSP) from the His bundle (HB) or left bundle branch area (LBBA) is an increasingly used technique for physiological ventricular pacing. Recently, implantable cardioverter defibrillator (ICD) leads in CSP locations have emerged as a novel method to deliver pacing, sense sustained ventricular arrhythmias (SVA) and deliver defibrillation successfully, while reducing the number of leads in patients with both cardiac resynchronization therapy (CRT) and ICD needs. A study to optimize the location of ICD leads in defibrillation simulations exhausting all LBBA implantation options has not previously been reported.

**Methods:** A preliminary cohort of five CT-derived whole torso-cardiac computational models was used to assess the DFT by simulating an electric shock application between equally spaced ICD lead placements from the left bundle trunk (LBT) area to the right ventricular (RV) apex along the septum. The septum was further divided into target areas: left septal fascicle (LSF) and left posterior fascicle (LPF). A sub-cohort of three was used to further investigate the DFT as the lead moves position inferiorly-anteriorly to target the LSF and LPF. All leads penetrated the septum until the tip reached the left ventricle endocardium for LBBA defibrillation. The clinical RV leads were simulated for comparison.

**Results:** Our study found that optimal lead implantation was in low apical positions rather than towards the basal LBT, decreasing the average DFT linearly by up to 54.32%. The sub-cohort further reveals that the optimal lead locations target the overlap of the LSF and LPF (15.1 ± 8.6 J). Inversely, the ICD is least efficient anteriorly of the LSF, towards high mid-cavity positions, increasing the average DFT threefold (48.9 ± 27.8 J). The optimal lead placement decreases the DFT compared to clinical positions (25.5 ± 22.2 J).