

Abstract

An AI-driven software system for cardiac intervention planning, called AI Substrate-Planner and LBBAP Depth Guide, is disclosed. The system integrates multimodal cardiac data—including pre-procedure imaging (MRI), intraprocedural intracardiac echocardiography (ICE), real-time electrograms (EGM), and optional shear-wave ultrasound and lesion formation metrics—to assist clinicians in two key areas: (1) automated ablation lesion planning with suggested lines and lesion endpoints in cardiac tissue, and (2) optimal screw-in depth prediction for left bundle branch area pacing (LBBAP) leads based on patient-specific septal anatomy and tissue properties. The system's architecture comprises data interfaces to standard electrophysiology (EP) mapping systems and pacing lead delivery tools, an AI inference engine (cloud-based or edge-deployed) that produces guidance outputs, and a user interface that overlays recommendations on cardiac maps or imaging views. Novel aspects include the fusion of imaging and electrical mapping data to predict optimal ablation targets and pacing lead depth, improving procedural accuracy and outcomes. The system can function as adjunctive clinical decision support or as a regulated Class II software medical device, with multiple embodiments (cloud service or on-premises device) and flexible modalities (imaging-only or combined data models). The invention also encompasses training frameworks for the AI models using historical procedure data and outcomes. The integrated approach improves success in achieving transmural lesion sets for arrhythmia ablation and precise conduction system capture for LBBAP lead placement.