A comparison of Lesion Index, Force Time Integral, and Contact Force in catheter ablation procedures

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Introduction: Atrial Fibrillation (AF) is the most common arrhythmia encountered in clinical practice. Due to its fast and chaotic rhythm, the atria cannot contract effectively, resulting in decreased blood flow. AF is a major cause of stroke, heart failure, sudden death, and cardiovascular morbidity. AF is also associated with high rates of hospitalization due to AF management, heart failure, myocardial infarction, and treatment associated complications. Pulmonary vein isolation (PVI) is the cornerstone therapy for AF, but its effectiveness is dependent on the successful isolation of the pulmonary veins (PVs). Contact force (CF) sensing catheter systems provide operators with information on how much force is being applied by the catheter tip on the cardiac wall – a key factor in determining effective lesion formation. The 2017 HRS/EHRA/ECAS/APHRS/SOLAECE Expert Consensus on AF Ablation provided targeted CF recommendations during ablation. However, CF is just one factor in lesion formation, radiofrequency (RF) current and duration have also been demonstrated to influence lesion size. The Force Time Integral (FTI) is a bilinear model that combines CF and RF ablation time. Previous studies have established a minimum FTI threshold of 400 gram-seconds that was associated with significantly lower rates of gaps at 3-months. The LSI Index (LSI) is a product-of-exponentials algorithm that expresses the gradual growth of lesion formation and is dependent on CF, RF duration, and RF current. In vitro studies showed the predictive performance of LSI with respect to lesion dimension is stronger than FTI. However, to date, there are no established guidelines on the clinical utilization of LSI values in lesion formation. Using the EnSite Precision cardiac mapping system with the TactiCath Quartz or the TactiCath Sensor Enabled (SE) ablation catheters with CF measuring capability allows the operator to use one or more of these values to guide their ablation strategy.

Methods: The goal of this work was to compare LSI values for PVI lesion sets with their FTI and average CF values, evaluating their relationship to each other and to measures of effectiveness such as first-pass PVI success (without reconnection during the procedure) and freedom from AF recurrence. EnSite case files and outcomes data were collected from 4 independent centers on over 250 different procedures to treat paroxysmal Atrial Fibrillation using LSI-guided RF catheter ablation.

Result: Utilizing data from EnSite AutoMark files, LSI values achieved in different anatomical regions around the left atrium were compared with FTI and average CF achieved values.

Conclusion: These results may provide additional insight and guidance into the optimal metric for use during RF ablations.