Ablation Technique in Persistent Atrial Fibrillation

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Despite multi-center studies comparing catheter-based ablation strategies (ABS) in persistent atrial fibrillation (Afib) population, there were no significant benefits with additional linear ablations to address the substrates. However, there several clinical evidences strongly suggest that substrate ablation should be integral part of persistent Afib ablation.

The discrepant findings may be due to the poor classification of the Afib population and inability to create and confirm consistent trans-mural lesions without increasing collateral damage during the ablation. There is no general consensus and defined ablation strategy for persistent Afib until present time. There have been reports with limited and individual center study that used wide range of ablation strategies including the endo and epicardial ablations.

In effort to evaluate the substrate of Afib, high density (HD) or ultra-HD mapping systems have been used in past 3 years. Carefully obtained HD maps during sinus or atrial pacing were able to identify the low voltage areas that often show abnormal impulse propagation including the delayed conduction or block suggestive of arrhythmic substrates.

Our limited HD mapping study in persistent Afib pts showed that current clinical classification of Afib paroxysmal, persistent and long -standing persistent Afib was not useful to guide the ablation strategy. HD mapping study showed that up to 17% of paroxysmal atrial fibrillation pt with LAV volume < 90 ml using MRA criteria showed variable regions of low voltage (bipolar EGM < 1.0 mV) or scarred area (< 0.1 mV). Inversely, 8 % of non-paroxysmal atrial fibrillation LAV >90 ml had normal voltage map with normal propagation suggestive of absence of arrhythmia substrate. Several investigators have been proposing Afib classification during ablation in two categories: atrial myopathic and non-myopathic fibrillation.

The voltage mapping is readily available in most the EP labs but it has many limitations: the resolution of the map is highly depending on biophysics of catheter electrode size, recording configurations, impulse propagation directions (sinus vs atrial pacing) and catheter contact with substrate. Despite the limitations, the voltage mapping is not only readily available but also have been used for several decades in EP labs and convenient to use during ablation.

We have been using HD mapping to guide to individualize ablation strategy to minimize the destruction of normal voltage area and minimize the lesion sets even for the linear ablations with PVI. The short-term outcome of HD mapping guided ablation results was compared to the data from the pre-HDM. The result showed that overall outcomes are not inferior and complications were lower. There was significant reduction in ablation number, duration and total energy delivered but the procedure time was similar due to the longer mapping time.

Conclusion:

Our early experience in HD mapping guided ablation strategy showed not inferior to the pre-HD mapping strategy. Multi-center with longer follow-up is needed to validate HD mapping guided ablation study in persistent atrial fibrillation pts.

Ventricular Tachycardia Ablation
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The ventricular arrhythmia (VA) have been characterized in detail last decade and changed our understanding and the practice of catheter-based ablations in structurally normal and abnormal heart pts.

In structurally normal heart LV VA:
Recent insights shown that anatomical complexity between the left ventricle out flow tract with the connecting anatomical structures including LV summit and the aortic cuspid including the left main coronary artery often imposes significant challenge in-term of mapping and energy delivery during ablation. The individual anatomical variations and preferential conduction propriety of VA focus, 12 lead ECG of VA can be used and can guide but may not be accurate enough to use as sole criteria. 2nd important insight was papillary muscles (PM) connections was highly prevalent in pts with VAs and possibly responsible for exhibit QRS variability, trigger activities and the maintenance of arrhythmia. These connections may explain in part exit site changes after the 1st successful ablation followed by VA QRS morphology changes creating confusion.

In structural normal heart RV VA: RV muscle origin VAs were characterized and classified as PMs, moderator band and infundibular muscles origins VAs. The infundibular muscle VAs can be divided septal and parietal band and the septal bundle VAs are less frequent than the parietal bundle origin. The ablation experiences showed that these VA's are difficult to ablation and associated with high recurrence rate. The VAs is possibly originated from deep myocardium and may exhibit preferential conduction that challenges the ablation procedures. The other VA's originated from RVOT region is Brugada syndrome related VAs and recent studies had variable success with the endocardial ablation only but the question is not completely settled.

In structurally diseased heart:
The high-density mapping (HDM) experiences showed that improved significantly in interrogation of the underlying arrhythmia substrate that allowed to target ablation in critical isthmus. The endocardial mapping is most common approach used to address sub-endocardial substrate found in ischemic heart disease but frequently epicardial mapping is very useful regardless the underlying etiology of VAs. Many challenges still remain to be resolved, especially VAs ablation related complications and the recurrences. Non-ischemic CM and septal VAs remain as the most technically challenging ablation and often requires unconventional ablation techniques including bi-polar, needle-based catheter ablations, ETOH infusion ablation or extra-corporeal photon beam ablation. These techniques mostly to target mid-myocardium and they are still considered as he experimental procedure.
Recent experiences from the high-density mappings showed that majority of pts who had more than one morphology of VAs inducible during the baseline EP study, the HDM from these pts showed majority of VAs shared same critical conduction zone within the substrate. Therefore, detailed baseline substrate map to identify the mid-diastolic potentials combined with conduction delay was essential to eliminate all VAs induce during baseline EP study.

Conclusion:
A significant progress has been made to address VAs with the catheter-based ablation in recent years. The HDM allows to obtain detailed map to target all critical conduction zones. Early experiences are encouraging due to the higher success rate, elimination of all induced VT.