# Electrogram voltage and pacing threshold before ablation, measured by mini-electrodes, predict parameters indicative of transmural lesions in the human atrium

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1) *Electrogram voltage and pacing threshold before ablation, measured by mini-electrodes, predict parameters indicative of transmural lesions in the human atrium, Almendral et al, Journal of Interventional Cardiac Electrophysiology https://doi.org/10.1007/s10840-019-00539-6*

**Overview**[1]

Researchers from Monteprincipe Hospital in Spain has investigated if parameters obtained from Mini Electrodes (ME) or conventional bipoles before RF application could predict a successful atrial lesion

One of the limitations of using a radiofrequency (RF) catheter ablation as therapy for cardiac arrhythmias is that the size of the lesions reduced in the heart is unknown.

The advent of catheters with mini-electrodes (ME) embedded in a larger ablation tip has provided the opportunity to test whether the information obtained from these ME correlates with the lesion produced by a regular ablation tip and in particular to predict an appropriate lesion size before or at the beginning of the RF application.

Thus, Researchers from Monteprincipe Hospital have aimed to study several parameters that can be obtained both with standard electrodes and ME before or at the beginning of the RF application. In the present study, they analyzed ***the extent to which electrogram voltage*** and ***pacing threshold prior to a RF application*** and ***time to loss of capture during ablation*** can predict findings of a successful lesion as previously described for the ME in atrial tissue

**Research Methods**[1]

Authors have prospectively included ***33 consecutive patients*** undergoing cavotricuspid isthmus (CTI) ablation. Electrogram voltages and pacing thresholds were measured with ME and conventional bipoles before and after radiofrequency (RF) applications. The time before the loss of capture during applications was recorded. Lesions were considered successful, in accordance with preclinical data, if ME voltage decreased > 54%. A deflectable 20 poles catheter was placed along the tricuspid annulus (TA), a quadripolar catheter was placed at the coronary sinus and ablation was performed with an ***ablation catheter with ME embedded in an 8-mm tip (Intella Tip MIFI)*** and RF applications were delivered in the conventional way according to the best clinical practice.

The lesion set included successive RF applications along a theoretical line crossing the CTI midway between its septal and lateral aspect as seen in the 45° left anterior oblique fluoroscopic projection, starting at its ventricular side and terminating at its caval end. After the delivery of each application, the catheter was carefully moved under fluoroscopic guidance to another position as stable as possible.

Each fluoroscopic catheter position in which an RF application was delivered was “frozen” in a second fluoroscopic screen for reference. If conduction persisted, conduction gaps were searched for by exploring electrical signals along the ablation line during sinus rhythm or coronary sinus pacing, and additional RF lesions were delivered. The procedure finished when bidirectional conduction block across the CTI was achieved and persisted for at least 30 min.

Patients were followed up for at least 6 months and the symptomatic and clinical status was evaluated along with a 24-h Holter monitoring and a 12-lead ECG.

The following data were obtained, all measurements and stimulation from the ME were performed from the bipole with the largest amplitude:

- bipolar pacing thresholds with both the conventional configuration (tip to ring) and the ME before and after each RF application
- bipolar electrogram amplitudes of both the conventional configuration (tip to ring) and the ME before and after each RF application
- times to loss of capture during RF energy delivery

**Conclusion**[1]

The influence of RF applications on electrophysiologic parameters such as **bipolar electrogram voltage** and **pacing threshold** was found to be **more intense** when those parameters are derived **from ME embedded in an 8-mm tip** as opposed to conventional bipoles. In contrast to the observations from conventional bipoles, **pre-ablation ME electrogram voltage and pacing threshold independently predicted a successful lesion**, as defined using criteria derived from preclinical studies in atrial tissue. These parameters could be used prior to lesion delivery and could likely improve lesion quality.

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**Main Finding[1]:**

Of 207 applications, 107 could be analyzed below a summary of the main finding:

- Standard RF applications produced a **higher decrease in electrogram voltage and a higher increase in pacing threshold at the ME bipole** than with the conventional tip to ring bipole

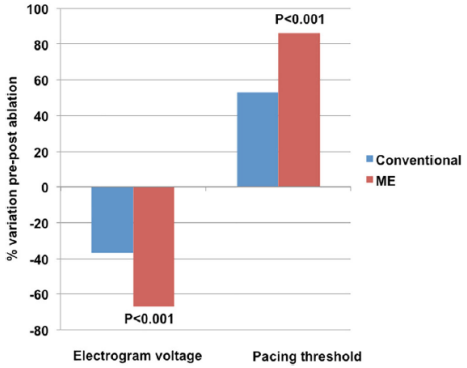


Figure 1

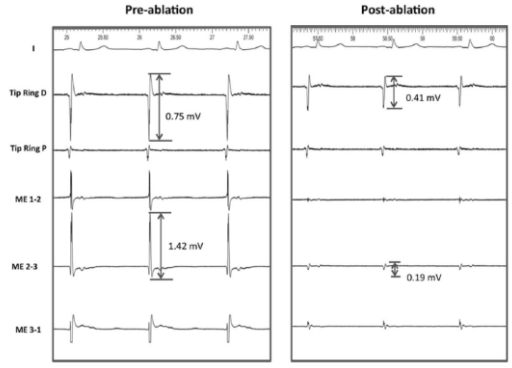


Figure 2

Fig 1 - Reduction in electrogram voltage and increase in pacing threshold as a result of RF applications. Note that variations are significantly more important with mini-electrodes (ME) than with conventional (tip to ring) electrodes
Fig 2 - Example of reductions in electrogram voltage after RF applications. The tracings show lead II and bipolar recordings from the conventional electrodes (distal, D, proximal P) and the mini-electrodes (ME) pre- and post-ablation in the same patient and site. Note that pre ablation the voltage of the mini electrodes is higher than that of the conventional recordings. Also note that reductions are seen in all recordings but are more intense in the ME recordings (87% reduction in ME, 45% in the conventional distal bipole)

- **A higher electrogram voltage and a lower pacing threshold with ME predicted a successful lesion**, as defined using criteria derived from preclinical studies in atrial tissue (Decreases in Voltage amplitude exceeded 54%)

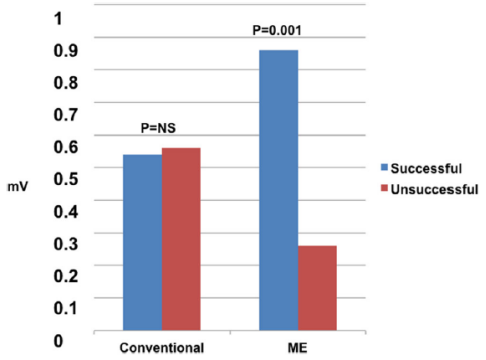


Figure 3

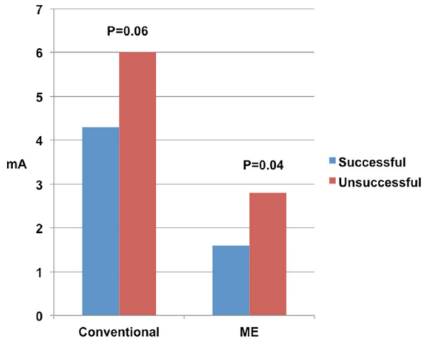


Figure 4

Fig 3 - Pre-ablation electrogram voltage at lesions considered successful or unsuccessful. Note that there is lack of significant difference with the conventional configuration (tip to ring) vs a significant difference with mini-electrodes (ME)
Fig 4 - Pre-ablation pacing threshold at lesions considered successful or unsuccessful. Thresholds with the mini-electrodes (ME) were significantly lower at successful sites. Note that there is not a significant difference between the conventional configuration (tip to ring) and minielectrodes (ME)

- Authors demonstrate for the first time that pre-ablation bipolar amplitude and pacing threshold, as obtained with the ME, were significantly different for successful vs unsuccessful lesions, and in fact, **an amplitude > 0.32 mV and a pacing threshold < 1.5 mA predicted a successful lesion with a Sensitivity of 52%, Specificity of 85% and a Positive predict value of 91%**

| Parameter | Sensitivity | Specificity | PPV | NPV | Accuracy | OR | 95% CI |
|---|---|---|---|---|---|---|---|
| ME electrogram voltage > 0.33 mV | 78% | 78% | 91% | 54% | 78% | 12.1 | 4.2–34.4 |
| Pacing threshold < 1.5 mA | 60% | 59% | 81% | 33% | 60% | 2.2 | 0.9–5.3 |
| Electrogram voltage > 0.33 mV and pacing threshold < 1.5 mA | 52% | 85% | 91% | 38% | 61% | 6.3 | 2.0–20.0 |

Table 1

Tab 1 - Sensitivity, specificity, positive and negative predictive values (PPV, NPV), and accuracy for the best ME pre ablation voltage and the best ME pre-ablation pacing threshold cut-offs to predict a successful ablation lesion. Odds ratios (OR) and 95% confident intervals (CI) of the OR are also provided


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