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Troponin Release after Pulmonary Vein Isolation using Pulsed Field Ablation compared to Radiofrequency and Cryoballoon Ablation

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Pulmonary vein isolation (PVI) is the cornerstone of interventional atrial fibrillation (AF) treatment. Current ablation modalities include radiofrequency ablation (RF), cryo-ablation and the recently available pulsed field ablation (PFA).¹ Little is known on differences in post-procedural cardiac biomarkers as a marker of cardiac injury. We therefore investigated releases in high-sensitivity Troponin-T (hsTnT) after each modality.

We prospectively enrolled 60 patients undergoing their first PVI (20 per ablation modality) at two Swiss centers and measured hsTnT one day before and the morning after the procedure (Elecsys 2010 high-sensitivity troponin T, Roche Diagnostics). For RF we used irrigated-tip Thermocool[®] catheters at 25-50W (Biosense Webster), for Cryo-ablation 28mm Arctic Front Advance Pro[®] balloon catheters (Medtronic) and for PFA Farawave[®] catheters (Boston Scientific). Besides PVI, no additional lesion sets were performed. The study was approved by the local ethics committees and adhered to the Helsinki Declaration. Mean and median values were compared with ANOVA and Kruskal-Wallis tests, respectively, and between group comparisons with post-hoc analyses using SAS[®] Studio and SPSSv28.0.1.0.

Overall, mean (standard deviation [SD]) age was 66.4 (10.9) years, 19 (31.7%) patients were female and 34 (56.7%) patients had paroxysmal AF. Mean (SD) CHADS-VASc score was 2.3 (1.3), left atrial diameter 40.7 (6.9) mm and left ventricular ejection fraction 56.3 (11.1)%. Comparing RF, Cryo and PFA, we found no significant differences in age (63.9, 64.7 and 70.6 years; $p=0.10$), LA diameter (42.8, 39.3 and 38.9 mm; $p=0.23$) or paroxysmal AF (11, 12 and 11 patients; $p=0.93$), but PFA patients had a higher CHA₂DS₂-VASc score (2.1, 1.9 and 3.0; $p=0.03$). Respective ablation times for RF and Cryo were 1328 (316) and 1097 (325) seconds and 38.2 (13.3) applications for PFA (84 [29] seconds). Pre-interventional mean (SD)

hsTnT levels were slightly higher in the PFA group (15.2 [10.7]) compared to RF (8.9 [4.3]; $p=0.02$) and Cryo (8.0 [3.3] ng/l; $p=0.005$). Post-interventional mean (SD) hsTnT levels were considerably higher in the PFA group (1571.0 [691.4]) compared to RF (962.3 [376.5]; $p<0.001$) and Cryo (832.6 [251.1] ng/l; $p<0.001$). The mean (SD) change in hsTnT was significantly higher in the PFA group (1555.9 [689.7]) compared to the RF (953.4 [376.2]; $p<0.001$) and Cryo (824.7 [251.3] ng/l; $p<0.001$) groups, while we did not identify a difference between the latter two groups ($p=0.67$) (Figure). Median (interquartile range) changes in hsTnT were similarly higher in the PFA group (1377.0 [1047.0-1939.5]) compared to the RF (911.5 [747.0-1128.5]; $p=0.003$) and Cryo (762.5 [653.0-964.0] ng/l; $p=0.002$) groups with no difference between the latter two ($p=0.49$).

We found hsTnT releases after PFA to be approximately 1.6 and 1.9 times higher compared to RF and Cryo-ablation, respectively. Intuitively, this higher increase in cardiac biomarkers may be a surrogate for larger, more antral lesions created by the flower shape of the Farawave[®] catheter. However, a recent study showed similar extent and morphology of PVI by PFA and thermal energies.² Alternatively, the larger increase in biomarkers may indicate more comprehensive ablation inside the pulmonary vein antrum by the basket shape of the Farawave[®] catheter compared to linear, antral ablation by thermal energies. Prospective studies need to investigate if the more pronounced increase in cardiac biomarkers after PFA translates into enhanced lesion durability over time or impacts safety compared to other modalities. Limitations of our study include the cross-sectional non-randomized design, the limited sample size and the lack of clinical outcomes to investigate the clinical significance of different hsTnT releases.

In conclusion, we found a significantly higher increase of hs-cTnT as a surrogate for myocardial injury after PFA compared to RF and cryo-ablation.

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Disclosures

MK reports personal fees from Bayer, personal fees from Böhringer Ingelheim, personal fees from Pfizer BMS, personal fees from Daiichi Sankyo, personal fees from Medtronic, personal fees from Biotronik, personal fees from Boston Scientific, personal fees from Johnson&Johnson, personal fees from Roche, grants from Bayer, grants from Pfizer, grants from Boston Scientific, grants from BMS, grants from Biotronik, grants from Daiichi Sankyo; **PK** received grants from the University of Basel, the Mach-Gaensslen foundation and the Bangerter-Rhyner foundation; **SK** reports grant from the Stiftung Kardiiovaskuläre Forschung, outside the submitted work; **CS** has received speaker honoraria from Biosense Webster, Boston Scientific and Medtronic and research grants from Biosense Webster, Daiichi-Sankyo, and Medtronic; He is a proctor for Medtronic (Cryoballoon). **PB** received grants from the University of Basel, Stiftung für Herzschrittmacher und Elektrophysiologie, Johnson&Johnson and personal fees from Abbott. **TR** received research grants from the Swiss National Science Foundation, the Swiss Heart Foundation and the sitem insel support fund. Speaker/consulting honoraria from Abbott/SJM, Bayer, Biosense-Webster, Biotronik, Boston-Scientific, Daiichi Sankyo, Farapulse, Medtronic and Pfizer-BMS paid to his institution without effect on his personal remuneration. Support for his institution's fellowship program from Abbott/SJM, Biosense-Webster, Biotronik, Boston-Scientific and Medtronic. **LR** received speaker/consulting honoraria from Medtronic and Abbott.

Data Availability

All data will be shared upon reasonable request to the corresponding author.

References

1. Reddy VY, Neuzil P, Koruth JS, et al.: Pulsed Field Ablation for Pulmonary Vein Isolation in Atrial Fibrillation. *J Am Coll Cardiol Journal of the American College of Cardiology*, 2019; 74:315–326.
2. Kawamura I, Neuzil P, Shivamurthy P, et al.: How does the level of pulmonary venous isolation compare between pulsed field ablation and thermal energy ablation (radiofrequency, cryo, or laser)? *Eur Eur Pacing Arrhythm Card Electrophysiol J Work Groups Card Pacing Arrhythm Card Cell Electrophysiol Eur Soc Cardiol* 2021; 23:1757–1766.

Figure legends

Figure **Change in high-sensitivity Troponin T stratified by ablation modality.** Boxes contain interquartile range, horizontal lines the median, crosses and numbers the mean, whiskers the most extreme values within 1.5* interquartile range and further values as individual points.

