VIA MEDICA

RESEARCH LETTER

Cardiology Journal
2024, Vol. 31, No. 6, 920–921
DOI: 10.5603/cj.102484

ISSN 1897–5593
eISSN 1898–018X

Insights from pulse field energy in patients with prosthetic mechanical heart valves undergoing ablation for atrial fibrillation

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Introduction

Pulse field ablation (PFA) is a new energy source used for ablation in patients with atrial fibrillation (AF) [1]. However, some data advocate its application also in atrial tachycardia ablation [2]. To date, there is limited data on the safety profile of this procedure in patients with prosthetic heart valves, as they are usually excluded from clinical trials and registries [3, 4]. The proximity of prosthetic material in the heart can reduce the efficacy of high-voltage energy used for PFA due to possible energy dispersion.

Additionally, caution should be taken when manipulating any ablation system in the left atrium (LA) due to the risk of catheter entrapment in the mitral prosthetic valve. The present study aimed to present the feasibility and safety profile of PFA with a penta-spline catheter in patients with prosthetic mechanical heart valves, either in the mitral or aortic position.

Methods

In this observational study, patients were prospectively enrolled with prosthetic heart valves who underwent AF ablation with the novel penta-spline PFA catheter (FaraWave, Farapulse-Boston Scientific Inc., Marlborough, USA). The procedures were performed in three electrophysiology centres in Poland by operators experienced in AF ablation in patients with prosthetic valves using different technologies, such as radio-frequency (RF) ablation or cryoablation (CB). All procedures were performed under unconscious sedation or general anaesthesia. In four cases, intracardiac echocardiography imaging (ICE) was used to assist with the transseptal puncture, assessment of the catheter-tissue contact and proper function of prosthetic valve discs to avoid catheter entrapment in the mitral valve prosthesis, whereas in the rest of cases fluoroscopy was the only visualisation modality employed to support catheter positioning.

Pentaspline PFA catheter (FaraWave, Farapulse-Boston Scientific Inc., Marlborough, USA) was introduced through the dedicated 13-Fr steerable sheath (Faradrive, Farapulse-Boston Scientific Inc., Marlborough, USA) into the LA over the wire. A minimum of four pairs of PFA applications per pulmonary vein were performed, with additional applications performed in different aspects of pulmonary veins if needed in order to obtain pulmonary vein isolation (PVI) or to perform posterior wall isolation. The movement of the prosthetic valve discs was recorded before and after each application to ensure its proper function.

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Received: 7.09.2024 Accepted: 4.11.2024 Early publication date: 2.12.2024

Out of 598 performed PFA procedures in these centres, 14 patients were enrolled in the final analysis, with a median (IQR) age of 61 (53.25; 69.25), 50% female. In 10 patients (71%) a mitral valve prosthesis was present, whereas aortic prosthetic valves were present in four patients. 3 out of 14 patients had a history of tricuspid valve intervention performed in the past. In 9/14 patients, PFA was a redo procedure. The PVI was successfully achieved in all patients, and the posterior wall isolation was performed in 13 patients (93%). The median (IQR) number of PFA applications was 75 (52.75; 89), with a median (IQR) procedure time of 67.5 (60.75; 80) minutes. Procedural data were presented in **Supplementary Table 1**. No acute and peri-procedural complications were noted.

All patients had TTE performed after the procedure, which revealed no changes in the function of the prosthetic valve. A mid-term follow-up of a median (IQR) of 160 (101.75; 215) days was available in all patients. In 11 (79%) cases, there were no atrial arrhythmia recurrences of the AF or AT.

Conclusions

The main findings are as follows: firstly, PFA is feasible and has a favourable safety profile in patients with prosthetic heart valves both in the mitral or aortic position. Secondly, PFA can lead to effective and efficient workflow in patients with often enlarged left atria in terms of procedural duration, LA dwell time, and completeness of pulmonary vein isolation.

The unquestionable advantage of pulse field energy in this group of patients is the deeper penetration of the energy into the left atrial wall [5], often hypertrophied in patients after cardiac surgery [6]. That is unachievable for any other type of energy while maintaining safety regarding collateral damage. The limitations of the study include small sample size and a non-randomized setting.

In conclusion, the application of PFA energy at a short distance to the prosthetic valve in a patient undergoing ablation for AF is safe. Nevertheless, more patient data and longer follow-up are mandatory.

Data availability statement: Data supporting this study are included within the article.

Ethics statement: The research was conducted in accordance with the principles embodied in the Declaration of Helsinki and in accordance with local statutory requirements.

Author contributions: All authors have the revised manuscript, which is critically for important intellectual content and approval of the final version.

Funding: None declared.

Acknowledgments: All authors have the revised manuscript, which is critically for important intellectual content and approval of the final version.

Conflict of interests: None declared.

Supplementary material: Supplementary video; Supplementary Table 1.

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