

A pilot study of high-density mapping of left atrial scarring in patients with a history of cancer treatment undergoing ablation of arrhythmia: The Pilot OncoLA Study

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DOI: 10.33963/v.phj.99679

Received:

February 2, 2024

Accepted:

March 4, 2024

Early publication date:

March 12, 2024

INTRODUCTION

Treatment of arrhythmias, especially atrial fibrillation (AF), is one of problems of cardio-oncology [1–3]. Several potential mechanisms for arrhythmogenesis were described but left atrial (LA) scarring (fibrosis) due to anti-cancer treatment was not among them [1, 4, 5]. A growing body of evidence suggest that catheter ablation (CA) of AF in patients with a history of cancer is effective and safe; however, published studies are generally retrospective and prone to some biases [6–10]. Left atrial scarring may contribute to AF, and its isolation or elimination may improve outcomes of CA of AF [11–13]. Few data were published on the prevalence and potential relationship between the presence of scars in the LA and the history of cancer treatment [14].

This study aimed to assess the prevalence and characterize left atrial scar in patients with a history of cancer treatment who were scheduled for catheter ablation of arrhythmia.

METHODS

This was a prospective pilot study without a control group. The study protocol was approved by the local Institutional Review Board (IK.NPIA.0021.67.1994/22) and was in full compliance with the Declaration of Helsinki. Separate written informed consent for both the ablation procedure and the research project was obtained from all enrolled patients.

Eligible patients were consecutive adults scheduled for CA due to symptomatic arrhythmia who had a history of either chemotherapy or chest radiotherapy due to cancer; patients with active cancer were excluded from the study unless they had a previous history of cancer treatment and a relapse of the disease. Eligible patients were screened in the main and cooperating centers and scheduled for ablation based on typical indications for catheter ablation of arrhythmia. The enrollment was completed by the end of 2023 due to time constraints imposed by the National Science Centre grant. General and clinical data (including age, sex, co-morbidities, index arrhythmia, echocardiography parameters, and history of oncological treatment) were extracted from the hospital records and patient-derived medical documentation. In all patients, diagnostic catheters were positioned in the coronary sinus and His bundle area (Hagmed, Rawa Mazowiecka, Poland or Abbott, St. Paul, MN, US), and the LA was accessed *via* a fluoroscopy-guided transseptal puncture. LA mapping was conducted as part of standard CA procedure. Mapping was performed in sinus rhythm using a dedicated high-density catheter and a 3D mapping system: either Advisor HD Grid Abbott/Ensite Precision (Abbott, St. Paul, MN, US) or PentaRay/CARTO (Biosense Webster, Diamond Bar, CA, US). A scar was defined as a low-voltage zone (0.2 to 0.5 mV peak-to-peak bipolar voltage) with fragmented poten-

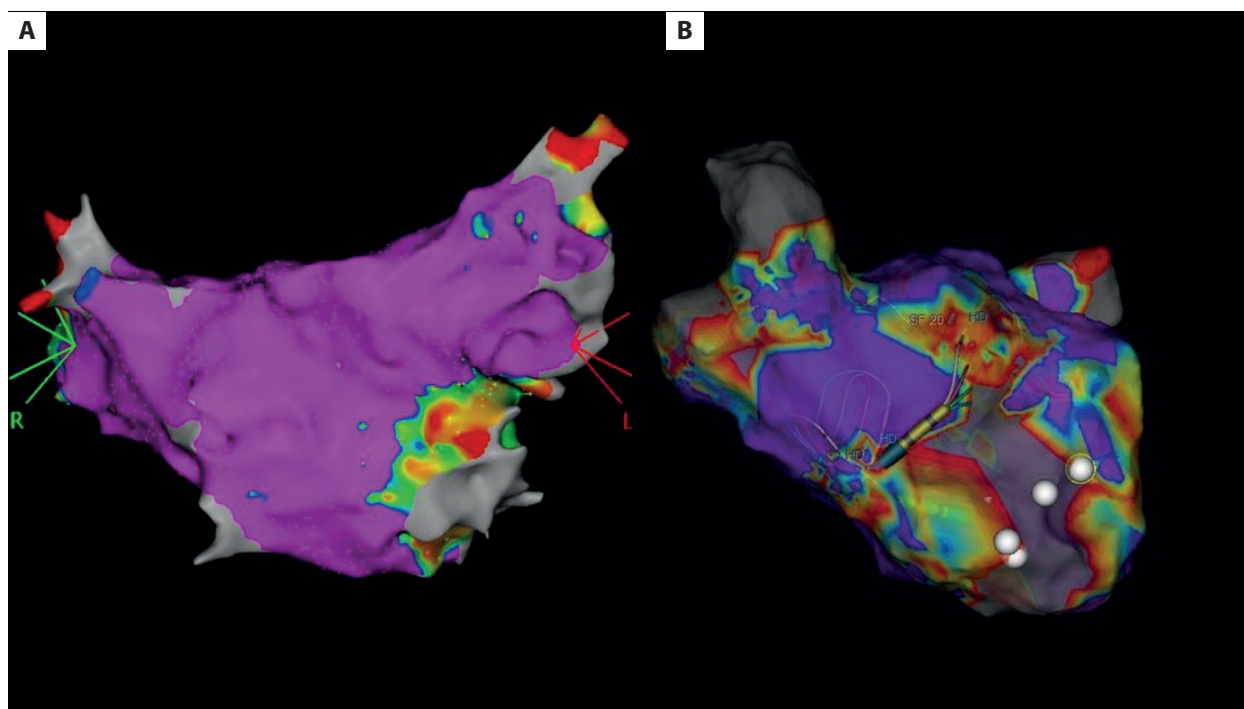


Figure 1. Comparison between the left atrium without fibrosis and with significant scarring of the anterior wall and septum. **A.** Purple color indicates normal voltage. **B.** Colors other than violet represent the scar

tials or dense scar (<0.2 mV) [11]. We included 6 segments in the analysis: the interatrial septum, anterior wall, inferior wall, mitral isthmus area, posterior wall, and roof. The area surrounding pulmonary veins was excluded because it is targeted during CA regardless of the technology. Due to the fact that the study was pilot, the following simplified definition of significant LA scarring was adopted: a scar covering at least half of one segment or a scar covering at least one-third of two separate segments. The long-term effectiveness of CA was beyond the scope of this study.

Statistical analysis

Due to the small size of the sample statistical analysis was limited to descriptive statistics. Results were presented as numbers (percentages), means (standard deviations), and medians (Q1–Q3).

RESULTS AND DISCUSSION

Between October 2022 and December 2023, 14 consecutive patients were enrolled at a mean age of 63 (11) years, with 9 (69%) males and 12 (92%) patients scheduled for atrial fibrillation (4 with persistent AF). Most of the patients had a history of lymphoma (38%) or breast cancer (31%), the median time from the end of cancer treatment to ablation was 4 (1–8) years; 13 (93%) patients had a history of chemotherapy and 8 (57%) history of chest radiotherapy. In two cases, detailed data on cancer treatment was unavailable due to lack of reliable medical records. Details of the baseline characteristics of enrolled patients were summarized in Supplementary material, *Table S1*. The

detailed history of cancer treatment was presented in Supplementary material, *Table S2*.

Significant LA scarring was found in 4 (28%) patients and was predominantly located in the anterior wall (3 patients, all with a history of radiotherapy, including only one with persistent AF). In two cases, the scar was targeted with radiofrequency ablation in addition to pulmonary vein isolation. **Figure 1** presents a comparison between the healthy (A) and significantly scarred LAs (B). *Figure S1* presents the anterior and posterior aspects of the LA without any fibrosis. *Figure S2* presents fibrosis on the anterior wall of the LA, together with fragmented potential within the scar. Besides one case of tamponade due to a transeptal puncture, no other complications were observed in the study patients.

The Pilot OncoLA Study found left atrial scarring in more than one-fourth of patients with a history of cancer who were scheduled for CA of arrhythmia. While published data suggest that CA of AF in patients with a history of cancer is effective and safe, less is known about optimal ablation strategy. Cryoballoon ablation seems to be equally effective in patients with and without a history of cancer [15]. Meanwhile, another study suggests that a history of chest radiotherapy in breast cancer might have a detrimental effect on CA [8]. One study focused on scar characterization in patients with a history of breast cancer [14]. Even though there was no statistical difference between the study and control groups in terms of area of low-voltage in the LA, a relatively high proportion of patients in both groups had anterior wall scarring. The LA mapping in that study was

conducted using a standard rather than a high-density catheter. In our pilot study, in a diverse population of patients with a history of cancer treatment, about one-fourth of patients had significant fibrosis of LA, mainly on the anterior wall and mainly in patients with a history of chest radiotherapy. What is interesting and not analogous to the general AF population, only one patient with anterior wall scarring had a history of persistent AF [13].

The initial outcomes of this pilot study suggest that there might be a subgroup of patients with AF and a history of cancer treatment who may benefit from 3D mapping and more extensive ablation beyond standard isolation of pulmonary veins. However, a much larger, possibly multicenter study focusing on high-density mapping and substrate modification ablation would be needed to confirm such an assertion. More than 70% of enrolled patients had no significant LA scarring suggesting that pulmonary vein isolation should be sufficient in the majority of patients who underwent cancer therapy, especially chemotherapy. At this point, little evidence has been published to unequivocally support one AF ablation strategy over another outside clinical investigation.

This study has several limitations due to its pilot design: a relatively small sample size, lack of the control group, diverse patient population, and evaluation of the main outcome, among others. Therefore, the presented outcomes should be interpreted with due caution and a larger study is necessary to help to develop an optimal strategy of CA in such patients.

Supplementary material

Supplementary material is available at https://journals.viamedica.pl/polish_heart_journal.

Article information

Conflict of interest: None declared.

Funding: The study was supported by a National Science Centre grant [2022/06/X/NZ5/00243, to MMF].

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REFERENCES

- Lyon AR, López-Fernández T, Couch LS, et al. 2022 ESC Guidelines on cardio-oncology developed in collaboration with the European Hematology Association (EHA), the European Society for Therapeutic Radiology and Oncology (ESTRO) and the International Cardio-Oncology Society (IC-OS). *Eur Heart J.* 2022; 43(41): 4229–4361, doi: 10.1093/eurheartj/ehac244, indexed in Pubmed: 36017568.
- Leszek P, Klotzka A, Bartuś S, et al. A practical approach to the 2022 ESC cardio-oncology guidelines: Comments by a team of experts — cardiologists and oncologists. *Kardiol Pol.* 2023; 81(10): 1047–1063, doi: 10.33963/v.kp.96840, indexed in Pubmed: 37660389.
- Tajstra M, Blamek S, Skoczylas J, et al. Two professions against two killer diseases: the rationale, organization, and initial experience of a cardio-oncology service. *Kardiol Pol.* 2021; 79(2): 139–146, doi: 10.33963/KP.15674, indexed in Pubmed: 33146505.
- Lee DH, Chandrashekhar S, Fradley MG. Electrophysiologic complications in cancer patients. *Methodist Debakey Cardiovasc J.* 2019; 15(4): 282–288, doi: 10.14797/mdcj-15-4-282, indexed in Pubmed: 31988689.
- Tamargo J, Caballero R, Delpón E. Cancer chemotherapy and cardiac arrhythmias: a review. *Drug Saf.* 2015; 38(2): 129–152, doi: 10.1007/s40264-014-0258-4, indexed in Pubmed: 25577497.
- Agarwal S, Munir MB, Krishan S, et al. Outcomes and readmissions in patients with cancer undergoing catheter ablation for atrial fibrillation. *Europace.* 2023; 25(9): euad263, doi: 10.1093/europace/euad263, indexed in Pubmed: 37655932.
- Costa TA, Felix N, Clemente M, et al. Safety and efficacy of catheter ablation for atrial fibrillation in cancer survivors: a systematic review and meta-analysis. *J Interv Card Electrophysiol.* 2024; 67(1): 211–219, doi: 10.1007/s10840-023-01677-8, indexed in Pubmed: 37950145.
- Haq IU, Akhiyat N, Anan AR, et al. Mediastinal radiation therapy for breast cancer in female patients is an independent risk factor for atrial fibrillation recurrence post-catheter ablation. *J Interv Card Electrophysiol.* 2022; 65(3): 751–756, doi: 10.1007/s10840-022-01341-7, indexed in Pubmed: 35963910.
- Thotamgari SR, Sheth AR, Patel HP, et al. Safety of catheter ablation for atrial fibrillation in patients with cancer: a nationwide cohort study. *Postgrad Med.* 2023; 135(6): 562–568, doi: 10.1080/00325481.2023.2218188, indexed in Pubmed: 37224412.
- Giustozzi M, Ali H, Reboldi G, et al. Safety of catheter ablation of atrial fibrillation in cancer survivors. *J Interv Card Electrophysiol.* 2021; 60(3): 419–426, doi: 10.1007/s10840-020-00745-7, indexed in Pubmed: 32377917.
- Rodríguez-Mañero M, Valderrábano M, Baluja A, et al. Validating left atrial low voltage areas during atrial fibrillation and atrial flutter using multi-electrode automated electroanatomic mapping. *JACC Clin Electrophysiol.* 2018; 4(12): 1541–1552, doi: 10.1016/j.jacep.2018.08.015, indexed in Pubmed: 30573117.
- Junarta J, Siddiqui MU, Riley JM, et al. Low-voltage area substrate modification for atrial fibrillation ablation: a systematic review and meta-analysis of clinical trials. *Europace.* 2022; 24(10): 1585–1598, doi: 10.1093/europace/euac089, indexed in Pubmed: 35696286.
- Barkagan M, Sroubek J, Shapira-Daniels A, et al. A novel multielectrode catheter for high-density ventricular mapping: electrogram characterization and utility for scar mapping. *Europace.* 2020; 22(3): 440–449, doi: 10.1093/europace/euz364, indexed in Pubmed: 31985784.
- Hashiguchi N, Schenker N, Rottner L, et al. Absence of detectable effect of radiotherapy and chemotherapy for breast cancer on the presence of low voltage areas in patients receiving left atrial catheter ablation. *Acta Cardiol.* 2021; 76(10): 1061–1068, doi: 10.1080/00015385.2020.1812892, indexed in Pubmed: 32914694.
- Eitel C, Sciacca V, Bartels N, et al. Safety and efficacy of cryoballoon based pulmonary vein isolation in patients with atrial fibrillation and a history of cancer. *J Clin Med.* 2021; 10(16), doi: 10.3390/jcm10163669, indexed in Pubmed: 34441965.