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The regional distribution of catheter ablations of atrial fibrillation and atrial flutter in Poland in 2023

Short title: AF/AFL ablations in Poland in 2023

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INTRODUCTION

Atrial fibrillation (AF) and atrial flutter (AFL) are the most prevalent, sustained arrhythmias in patients with cardiovascular diseases, constituting a major burden for individual patients, as well as for healthcare systems [1]. While ablation of typical, cavotricuspid isthmus-dependent AFL has been considered a golden standard of treatment, the optimistic results of the large, randomized trials, have increased confidence in the ablation of AF. Thus, the most recent consensus of the European Heart Rhythm Association, as well as the guidelines of the European Society of Cardiology, have expanded the indications for performing catheter ablation of AF [2, 3]. The primary strategy of ablation in patients with AF is pulmonary vein isolation, although in patients with refractory AF, the additional ablation targets in the left atrium, often including macroreentrant tachyarrhythmias, can be approached. Worldwide, ablations for AF and AFL are performed increasingly more frequently, and the novel ablation techniques are consecutively more frequently utilized [4]. However, major gaps exist in the availability of ablations depending on the analysed region [5]. The aim of the present analysis was to evaluate the distribution of the ablations of these two arrhythmias among Polish Voivodeships.

METHODS

The present analysis was performed based on data acquired by the provincial consultant in cardiology of the Silesian Voivodeship, from the National Health Fund, the sole Polish healthcare provider. The data consisted of the exact number of procedures performed in each Polish cardiology department according to the diagnosis-related groups (DRG), which are utilized for the reimbursement purposes. In brief, each admission is assigned with one specific DRG code, which should reflect both the complexity, as well as the cost of the procedure. Based on the DRG code (E43, E44, E46, E47, and E48) assigned to each admission, the total number of hospitalizations with cardiac ablations could be recorded. Moreover, by the combination of DRG groups with specific, primary diagnoses established by the ICD-10 codes, the number of ablations performed due to AF or AFL (I48) was obtained. Ablations were analyzed according to the E43 (arrhythmia ablation), E48 (pulmonary vein isolation), or E47 (complex ablation of arrhythmia using a 3D electroanatomical system), with primary I48 (atrial fibrillation/flutter) ICD-10 code. Each of the 16 Voivodeship divisions of the Polish National Health Fund reports such data, allowing for a regional analyses. According to the data from the

Statistics Poland, the total number of Polish citizens by the December 31, 2023 was 37.635 million [6].

As the comparative data, the results from the ESC Cardiovascular Statistics 2023 report have been obtained [7]. The report is a continuation of its previous edition and summarizes the statistics on both diagnoses, and CV procedures from 55 of 57 ESC countries. In the report, the division of the number of ablation procedures performed was made on the basis of countries' income into "high-income" and "middle-income". The data reported summarize the metrics from the year 2022 or the latest available between 2020 and 2022.

Statistical analysis

The number of procedures obtained from the ESC Atlas reflecting the originally presented data (median and interquartile range), with reports of 6 countries performing more than 750 overall catheter ablations per million citizens each year indicated in **Figure 1A**. In each Polish Voivodeship, the number of procedures was divided by the most recent available number of citizens. The number of AF ablations was also analysed as a quotient of the total number of ablations performed in each Voivodeship in 2023. The categorical variables were presented as absolute numbers and percentages. The continuous variables were presented with median values due to their non-normal distribution after assessment using the Shapiro–Wilk test. A two-sided *P*-value of less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

In 2023, a total of 29 297 ablations were performed in a total of 124 cardiology departments, with the majority of the procedures ($n = 11\,662$; 39.8%) being PVI, with 6 453 (22.0%) being complex ablations with 3D electroanatomical mapping. Thus, in 2023, the overall rate of catheter ablations in Poland per 1 million citizens was 778.45. In aggregate, there were 19,402 AF/AFL ablations, which constituted 66.2% of all ablations performed. Considering the total number of citizens in Poland, there were 515.5 AF/AFL ablations, including 309.8 PVI per 1 million citizens.

As presented in **Figure 1B**, the highest number of AF/AFL ablations was performed in the Mazowieckie Voivodeship ($n = 3387$), and the lowest in the Warmińsko-Mazurskie Voivodeship ($n = 251$), with the median number of 989 AF/AFL ablations per Voivodeship. The highest number of AF/AFL ablations per 1 million citizens was performed in the Lubelskie Voivodeship (672.3/1 million), with the lowest reported in the Warmińsko-Mazurskie Voivodeship (216.9/1 million), what can be seen in **Figure 1C**. Among all ablation procedures

performed, the percentage of AF ablations was highest (81.5%) in the Lubuskie Voivodeship, and the lowest in the Podkarpackie Voivodeship (52.6%). Considering the median number of AF/AFL ablations in the ESC countries reported as 159.1/million, in every Polish region the number of ablations exceeded this value. Moreover, there were 14 regions, in which the number of AF/AFL ablations was higher than the 75th ESC percentile, reported as 327.3/1 million.

In general, the reported data demonstrate high numbers of AF/AFL ablations performed in the Polish centres, when compared with the European statistics, as even in the region with the lowest number of AF ablations, the number of procedures per 1 million citizens exceeded the median for ESC countries. However, major differences can be noted, as reflected by an approximately 3-fold relative higher number of procedures between the regions with the highest and lowest numbers of ablations per million inhabitants. Such identification of differences between the regions may allow to more optimally allocate the resources. Similarly, regional analyses often demonstrate the locations with the lowest accessibility to invasive procedures, as well as indicate regions being closest to the saturation of the populational needs for a specific procedure. However, with an increasing number of patients diagnosed with AF, as well as a growing body of evidence supporting early AF ablation, one can expect further increases in the numbers of AF ablations, in both the Polish and the European setting.

Of note, there were two hospitals in Poland which have performed more than an overall of 1000 ablations in 2023, one in the Śląskie, and one in the Mazowieckie Voivodeship, while there were 16 facilities with less than an overall of 50 ablations per year. Considering the increasing body of evidence on the association between the higher safety and better long-term efficacy of procedures performed in the most experienced centres, these values demonstrate a relatively wide distribution of procedures among the centres [8].

There are few limitations that need to be taken into consideration. First of all, the reference data from the ESC Countries were obtained from the years 2020–2022, which could have been impacted by the surges of COVID-19 [9]. Second, the analysis based on the DRG and ICD-10 codes might convey improper classification, as some centres could classify a patient undergoing re-ablation with another primary ICD-10 diagnosis (e.g. heart failure).

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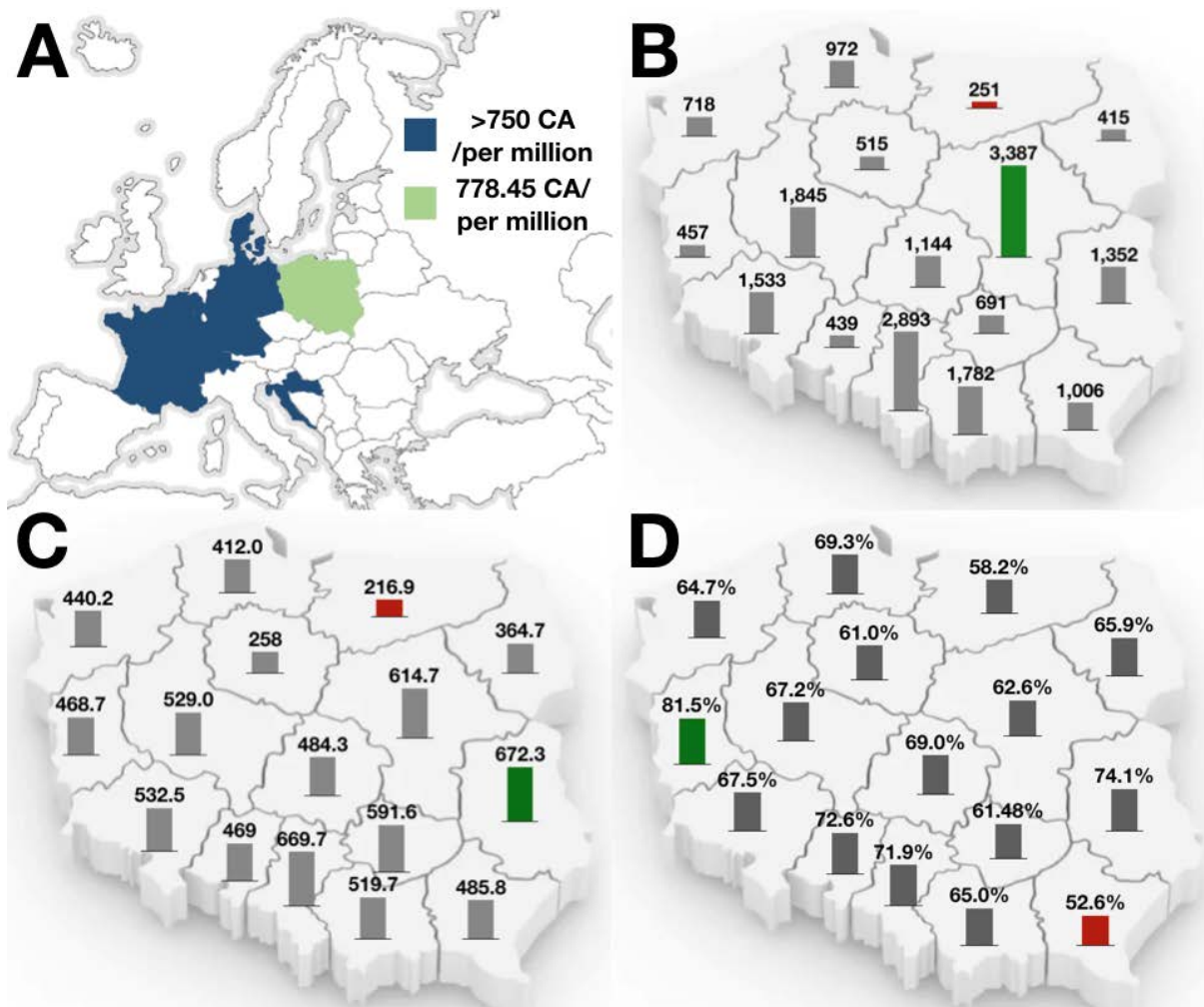


Figure 1. Summary of atrial fibrillation (AF)/atrial flutter (AFL) ablation procedures performed in 2023 in the Polish Voivodeships. **A.** The map of Europe, with countries in blue indicating >750 ablations in total per million inhabitants. **B.** Number of AF/AFL ablations in each Polish Voivodeship. **C.** Number of AF/AFL ablations per million inhabitants in each Polish Voivodeship. **D.** Percentage of AF/AFL ablations out of total ablations in each Polish Voivodeship. In subfigures **B–D**, the highest and the lowest absolute or relative values are indicated in respectively green and red