

# Long-term survival after cardiac surgery in male and female patients with underlying atrial fibrillation

Łukasz Kuźma<sup>1</sup>, Mariusz Kowalewski<sup>2-5</sup>, Karol Gostomczyk<sup>3</sup>, Radosław Litwinowicz<sup>6</sup>, Anna Kurasz<sup>1</sup>, Marek Jasiński<sup>7</sup>, Kazimierz Widenka<sup>8</sup>, Tomasz Hirnle<sup>9</sup>, Marek Deja<sup>10,11</sup>, Krzysztof Bartuś<sup>12</sup>, Roberto Lorusso<sup>5</sup>, Zdzisław Tobota<sup>13</sup>, Bohdan Maruszewski<sup>13</sup>, Piotr Suwalski<sup>2,3</sup>, on behalf of KROK Investigators

<sup>1</sup>Department of Invasive Cardiology, Medical University of Białystok, Białystok, Poland

<sup>2</sup>Department of Cardiac Surgery and Transplantology, National Medical Institute of the Ministry of Interior and Administration, Warszawa, Poland

<sup>3</sup>Thoracic Research Centre, Collegium Medicum Nicolaus Copernicus University, Innovative Medical Forum, Bydgoszcz, Poland

<sup>4</sup>Department for the Treatment and Study of Cardiothoracic Diseases and Cardiothoracic Transplantation, IRCCS-ISMETT, Palermo, Italy

<sup>5</sup>Cardio-Thoracic Surgery Department, Heart and Vascular Centre, Maastricht University Medical Centre, Maastricht, the Netherlands

<sup>6</sup>Department of Cardiac Surgery, Regional Specialist Hospital, Grudziądz, Poland

<sup>7</sup>Department and Clinic of Cardiac Surgery, Wrocław Medical University, Wrocław, Poland

<sup>8</sup>Clinical Department of Cardiac Surgery, District Hospital No. 2, University of Rzeszów, Rzeszów, Poland

<sup>9</sup>Department of Cardiosurgery, Medical University of Białystok, Białystok, Poland;

<sup>10</sup>Department of Cardiac Surgery, Medical University of Silesia, School of Medicine in Katowice, Katowice, Poland

<sup>11</sup>Department of Cardiac Surgery, Upper-Silesian Heart Center, Katowice, Poland

<sup>12</sup>Department of Cardiovascular Surgery and Transplantology, Jagiellonian University Medical College, John Paul II Hospital, Kraków, Poland

<sup>13</sup>Department of Pediatric Cardiothoracic Surgery, The Children's Memorial Health Institute, Warszawa, Poland

**KROK Investigators:** Lech Anisimowicz (Bydgoszcz), Krzysztof Bartuś (Kraków), Andrzej Biederman (Warszawa), Dariusz Borkowski (Radom), Mirosław Brykczynski (Szczecin), Paweł Bugajski (Poznań), Marian Buryś (Grudziądz), Paweł Cholewiński (Radom), Romuald Cichoń (Warszawa), Marek Cisowski (Bielsko-Biała), Marek Deja (Katowice), Antoni Działkowiak (Kraków), Tadeusz Gburek (Zamość), Witold Gerber (Bielsko-Biała), Leszek Gryczko (Warszawa), Ireneusz Haponiuk (Gdańsk), Piotr Hendzel (Warszawa), Tomasz Hirnle (Białystok), Stanisław Jabłonka (Lublin), Krzysztof Jarmoszewicz (Wejherowo), Jarosław Jasiński (Zielona Góra), Marek Jasiński (Wrocław), Ryszard Jaszewski (Łódź), Marek Jemielity (Poznań), Ryszard Kalawski (Poznań), Bogusław Kapelak (Kraków), Maciej A Karolczak (Warszawa), Jacek Kaperczak (Opole), Piotr Knapik (Zabrze); Michał Krejca (Łódź), Wojciech Kustrzycki (Wrocław), Mariusz Kuśmierczyk (Warszawa), Paweł Kwinecki (Wrocław), Leszek Markuszewski (Łódź), Bohdan Maruszewski (Warszawa), Maurycy Missima (Bydgoszcz), Jacek J Moll (Łódź), Wojciech Ogorzeja (Grudziądz), Jacek Pająk (Katowice), Michał Pasierski (Warszawa), Wojciech Pawliszak (Bydgoszcz), Edward Pietrzyk (Kielce), Grzegorz Religa (Łódź), Jan Rogowski (Gdańsk), Jacek Różański (Warszawa), Jerzy Sadowski (Kraków), Girish Sharma (Wrocław), Janusz Skalski (Kraków), Jacek Skiba (Wrocław), Ryszard Stanisławski (Nowa Sól), Janusz Stążka (Lublin), Sebastian Stec (Warszawa), Piotr Stepiński (Nowa Sól), Grzegorz Suwalski (Warszawa), Kazimierz Suwalski (Warszawa), Piotr Suwalski (Warszawa), Łukasz Tułeczki (Zamość), Kazimierz Widenka (Rzeszów), Waldemar Wierzbą (Warszawa), Michał Wojtalik (Poznań), Stanisław Woś (Katowice), Michał Oskar Zembala (Zabrze) and Piotr Żelazny (Olsztyn)

## Correspondence to:

Mariusz Kowalewski, MD, PhD,  
Clinical Department of Cardiac  
Surgery,  
Central Clinical Hospital of  
the Ministry of Interior and  
Administration  
Wolowska 137, 02–507 Warszawa,  
Poland,  
phone: +48 502 269 240,  
e-mail:  
kowalewskimariusz@gazeta.pl

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## INTRODUCTION

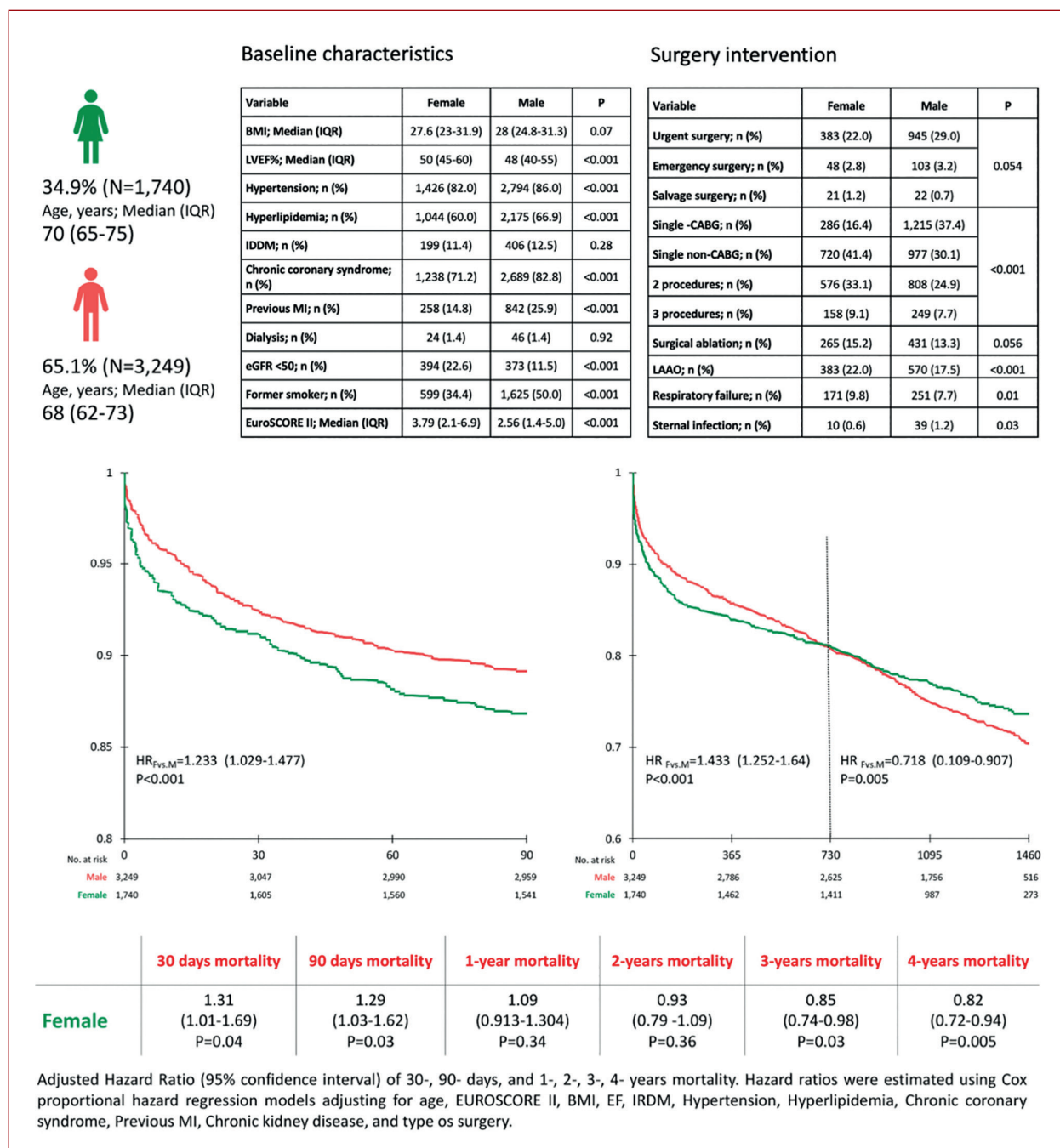
Atrial fibrillation (AF) remains the most common cardiac rhythm disorder, and due to its persistently growing trend, especially in the elderly population, it has become widespread the 21st century [1]. Based on a large, nationwide study, AF increases the risk of all-cause death by 3.7-fold and the risk due to cardiovascular death by 5 times compared with the general population [2]. Regarding the association of sex with AF, a meta-analysis of cohort studies reported that AF is a stronger risk factor for cardiovascular disease and mortality in women compared to men [3]. The prevalence of AF before cardiac surgery reaches up to almost 29% of patients [4]. Many studies observed that underlying AF has an

impact on short- and long-term outcomes after various cardiac procedures. In patients with concomitant aortic valve replacement and coronary artery bypass graft surgery (CABG), AF was independently associated with reduced mid-term survival [5]. It also substantially reduces long-term survival after a single CABG, which prompts the concomitant performance of surgical ablation [6]. It is even suggested that AF should be considered as a high-risk marker of complications after surgery [7]. However, there is a paucity of data on survival among male and female patients with preoperative AF undergoing cardiac surgery. This analysis aimed to assess the importance of sex in long-term survival following cardiac surgery in patients with underlying AF.

**METHODS**

Data were collected retrospectively from the Polish National Registry of Cardiac Surgery Procedures registry (KROK) (available at: [www.krok.csioz.gov.pl](http://www.krok.csioz.gov.pl)). The registry is an ongoing nationwide multi-institutional registry of heart surgery procedures in Poland; the details of the conception and design of the registry were described previously [8]. Due to the anonymization of registry data and the retrospective nature of the study, both patient consent and ethics committee approval were waived. The

registry included all adult patients with evidence of any type of pre-operative AF undergoing heart surgery for whatever reason between January 1, 2018 and March 31, 2020. Post-operative AF was not recorded and, therefore, not considered. For patients undergoing heart surgery, we considered and reported 3 categories of variables: (1) baseline demographics (2) surgical variables: urgency and operative technique (3) postprocedural complications (see Figure 1). All diagnoses of the variables studied were made based on current guidelines and those stated in EuroSCORE



**Figure 1.** Characteristics of study participants

Abbreviations: BMI, body mass index; CABG, coronary artery bypass grafting; EF, ejection fraction; eGFR, estimated glomerular filtration rate; IQR, interquartile range; IRDM, insulin-requiring diabetes mellitus; LAAO, left atrial appendage occlusion; LVEF, left ventricular ejection fraction; MI, myocardial infarction

II. In the case of hypertension, they were made based on guidelines stated in the CHA<sub>2</sub>DS<sub>2</sub>-VASc score. Diagnoses were made by KROK investigators and were not verified afterward. Normal distribution was assessed using a Shapiro–Wilk test. Descriptive analyses were represented as medians (Me) with interquartile ranges (IQR) for continuous variables, and for categorical variables as numbers (n) of occurrences (%). The statistical significance of differences between the two groups was determined using the  $\chi^2$  and Mann–Whitney U tests. The estimated survival probability was presented by Kaplan–Meier curves. The prognostic relevance of sex in the prediction of endpoints was estimated using univariable and multivariable Cox regression analysis. The multivariable Cox regression model included the variables with  $P < 0.05$  in the univariable model. The primary endpoint was death for women vs. men from any cause reported in an up to 4-year follow-up period. Follow-up status for all-cause mortality was confirmed by the Polish National Health Fund database and incorporated into the KROK registry. For all analyses, we set the level of statistical significance at  $P < 0.05$ . All statistical analysis was performed using Stata Statistical Software (StataCorp, 2023, version 18, TX, US).

## RESULTS AND DISCUSSION

The basic characteristics of patients and treatment data are shown in [Figure 1](#). The final study cohort consisted of 4989 patients with a majority of men (65.1%) and a median age of 69 years (IQR 63–74). The male population was characterized by a higher prevalence of risk factors for coronary artery disease such as hyperlipidemia and hypertension, as well as a greater prevalence of chronic coronary syndromes and earlier myocardial infarction. The female population was older and had a higher left ventricular ejection fraction, poorer renal function, and a higher prevalence of severe pulmonary hypertension. Moreover, women had a significantly higher score in the EuroSCORE II model (Me = 3.79 [IQR, 2.10–6.90] vs. 2.56 [1.44–5.00];  $P < 0.001$ ).

As for operative characteristics, men were more frequently undergoing single-CABG surgery (16.4% [n = 286] vs. 37.4% [n = 1215];  $P < 0.001$ ), whereas women more often underwent complex procedures. The female population was more often treated with left atrial appendage occlusion (22.01% vs. 17.54%;  $P < 0.001$ ); no differences between men and women were shown in the case of ablation. No differences were observed regarding surgery type (urgent, emergency, salvage) between the sexes.

Considering the overall in-hospital outcomes in our study group, the female cohort more often had after-procedural complications (27.07% [n = 471] vs. 23.08% [n = 750];  $P = 0.002$ ).

When analyzed by specific complication, there were no differences between the two groups except for sternal infections, which were more prevalent in men, and respira-

tory failures, which were more common in women (9.83% [n = 171] vs. 7.73% [n = 251];  $P = 0.01$ ).

During the initial period of follow-up, the female population was characterized by statistically significant poorer survival than men (90-days death: 11.44% [n = 199] vs. 8.93% [n = 290]; HR<sub>F vs. M</sub> = 1.233 [95% CI, 1.029–1.477];  $P < 0.001$ ). This trend reversed after the second year of follow-up (HR for 0–760 days 1.433 [95% CI, 1.252–1.640];  $P < 0.001$  vs. HR 760–1460 days 0.718 [95% CI, 0.109–0.907];  $P = 0.005$ ). Differences in factors that affected long-term prognosis were also however, there were no differences between the both sexes.

In our opinion, the initial poorer prognosis in the women's group stems from a higher perioperative risk, which is reflected in the EuroSCORE value. So far several studies reported that women achieve higher EuroSCORE values compared to men [8–10]. Trienekens et al. [9] observed that although women are at higher risk of early mortality, female sex is not an independent risk factor. The potential predictive underestimation of EuroSCORE in AF patients in our cohort was negligible due to AF being the baseline criterion for inclusion in this study [11]. Results from the United Kingdom National Adult Cardiac Surgery Audit on the overall population are consistent with our analysis showing an increased risk of short-term mortality after cardiac surgery in women [8]. Interestingly, in the case of after-procedural complications, females in the UK also had sternal infections more often than males. In our opinion, the shift in mortality that occurs over the second year may result from better long-term care in the female group and better compliance with treatment recommendations [12]. In the case of men who have a worse prognosis after the procedure, a greater emphasis on secondary prevention and close follow-up seem essential to better manage AF and co-morbidities. Extended follow-ups and statistical analyses are necessary for re-evaluating prevailing assumptions.

In conclusion, the female population is characterized by poorer survival after cardiac surgery, but this trend reverses after 2 years of follow-up. Differences in short-term and long-term mortality between sexes may be due to different AF courses in each sex.

This article has typical limitations of large retrospective registry studies. We noted <5% of missing data; moreover, AF type was not included in the patient analysis.

### Article information

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