Incidence and predictors of new-onset atrial fibrillation after cardiac surgery at Auckland City Hospital

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ABSTRACT

AIM: To describe the incidence, ethnic differences in incidence, and predictors of post-operative atrial fibrillation (POAF) after cardiac surgery in a New Zealand hospital.

METHOD: Analysis of registry data on 1,630 adults without previous atrial fibrillation having coronary artery bypass grafting and/or valve surgery was used to determine the incidence of POAF. Univariate analysis identified risk factors and stepwise logistic regression was used to create the most parsimonious model to predict POAF.

RESULTS: Overall POAF incidence was 29% (n=465) and differed by surgery type (25% after isolated coronary artery bypass surgery [CABG] vs 42% after combined CABG+valve). Incidence was highest in Māori (35%) and NZ/Other Europeans (32%). Māori and Pasifika with POAF were on average ten years younger than NZ/Other Europeans. Independent risk factors were age (OR 1.05, 95%CI 1.04–1.06), body mass index (OR 1.04, 95%CI 1.02–1.06), history of heart failure (OR 2.08, 95%CI 1.47–2.95), and valve surgeries (isolated valve OR 1.51, 95%CI 1.16–1.95; CABG+valve OR 1.59, 95%CI 1.11–2.28), but the model had poor discrimination (AUC 0.67).

CONCLUSION: POAF in a New Zealand hospital occurs at comparable rates to international settings. Risk models using routinely measured factors offer poor predictive accuracy, meaning risk stratification is unlikely to adequately inform targeted POAF prevention in clinical practice.

Atrial fibrillation (AF) is the most common complication after cardiac surgery, occurring in about 30% of patients who have no prior history of AF.[1] Although largely transient and self-limiting, the development of post-operative AF (POAF) increases use of hospital resources and is associated with prolonged hospital stay.[2] There is also increasing evidence that POAF is associated with poor perioperative outcomes, as well as higher rates of recurrent AF, stroke, and mortality in long-term studies.[3,4]

There are several strategies for POAF prevention, including pharmacological and surgical interventions. Prophylactic use of beta blockers or amiodarone show some reduction in POAF incidence.[5,6] However, the potential adverse effects of amiodarone may outweigh the benefits of reduced POAF incidence in some patients, and several guidelines recommend limiting amiodarone use to high-risk patients only.[7–9] The ongoing challenge is that there is currently no reliable framework to differentiate those at highest risk, and proposed risk models have not proven accurate enough for use in clinical practice or across different cardiac surgeries.[10] The use of targeted POAF prevention in clinical practice is therefore limited and prevention protocols vary widely between cardiothoracic centres in New Zealand and internationally.[9,11]

Little is known about POAF in New Zealand. The most recently published New Zealand Cardiac Surgery National Report describes a low national incidence of 23% but does not identify which patients are at highest risk in the New Zealand context.[12] Furthermore, it is not known at what rate POAF affects Māori and Pasifika populations. This research therefore aimed to describe the incidence of new-onset POAF following coronary artery bypass grafting (CABG) and/or valve surgery, explore differences in incidence by ethnic group, and to identify independent predictors of POAF in a New Zealand setting.

Methods

This study was an analysis of prospectively collected New Zealand Cardiac Surgical Registry (NZCSR) data from Auckland City Hospital, the largest cardiothoracic surgery centre in New Zealand. The study included consecutive patients

aged 18 years and over who had undergone CABG and/or valve surgery between 1 January 2019, and 31 March 2021, and survived for at least 24 hours post-operatively. Patients with a documented history of any prior AF/flutter were excluded. The primary endpoint was the development of AF/flutter during the post-operative period until discharge from the operating hospital. Ethical approval was given by the Auckland Health Research Ethics Committee (Application AH2808).

Standard post-operative care after cardiac surgery at Auckland City Hospital included monitoring on telemetry for at least 72 hours post-operatively, and routine electrocardiogram (ECG) taken on post-operative days 1, 3 and 5 (with additional ECGs as clinically indicated). A post-operative course of oral amiodarone for POAF prophylaxis was routinely given in all patients unless contraindicated, including loading doses of 400mg tds on days 1 and 2, and maintenance doses of 200mg bd continued until hospital discharge. Patients were generally considered for discharge from 5 days after surgery.

Variable selection

All data was obtained from the registry and no additional data was collected. Candidate variables were selected based on variables that showed evidence of an association with AF from a systematic literature review of similar studies.[13] Predictors were limited to factors that can be measured prior to the post-operative period to support the use of study results in preoperative risk assessment. The NZCSR database dictionary provided definitions for all variables, including the primary endpoint (incident POAF), defined as new-onset AF or atrial flutter requiring treatment. Renal impairment was classified according to creatinine clearance using the Cockcroft-Gault Equation and categorically classed as moderate (50–85mL/min) or severe (<50 mL/min). CHA_2DS_2-VASc score and estimated glomerular filtration rate (eGFR) were manually calculated using values from available data.

Ethnicity was categorised according to key populations within the New Zealand population. Registry data used prioritised ethnicity classification, which assigns patients to a single ethnic group in the order of Māori, Pasifika, Asian, Other non-NZ European and NZ European. NZ and Other European populations were combined as they were expected to share similar demographics and clinical characteristics. Indian ethnicity was separated from other Asian populations due to the higher observed burden of CVD.[14] Fijian Indian ethnicity was included as Indian rather than Pasifika. All residual ethnicity groups were categorised collectively as 'Other'.

Statistical analysis

All analyses were performed using IBM SPSS Statistics for Windows, Version 27.0. Categorical data were expressed using frequency and proportions. Continuous variables were assessed for normality of distribution using graphic analysis and were expressed using mean + standard deviation, or median and quartiles if normality assumptions were not satisfied. To analyse potential predictor variables, the cohort was divided by those that developed POAF in accordance with the database definition and those that did not. Univariate analyses identified unadjusted, primary associations. Continuous variables that were normally distributed were analysed using Student's *t* test, and if non-normally distributed using the Mann–Whitney U test. Categorical variables were analysed with Chi-squared or Fisher's exact test as appropriate. For all tests, a two-tailed *p* value below 0.05 was considered statistically significant. Statistically significant variables from univariate analysis were assessed for correlation in a correlation matrix. If correlation was noted, the most clinically significant variable from the correlation was retained. There were rare instances of missing data for predictor variables and therefore missing data was excluded via pairwise deletion to preserve the study power. Multi-variable logistic regression was used to identify independent predictors of POAF, using backwards and forwards selection to obtain the most parsimonious model. Variables in the final model are presented with *p* value, odds ratio and 95% confidence interval. The Hosmer–Lemeshow test and R^2 value were used to assess goodness of fit. Model sensitivity and specificity were assessed using a Receiver operating characteristic (ROC) curve.

Results

A total of 1,988 patients were screened for inclusion. Patients with a history of paroxysmal, persistent, or permanent atrial fibrillation/flutter were excluded (n=368). The final study sample consisted of 1,630 participants. Patient

ages ranged from 18 to 88 years, with a mean age of 63.5 years (SD 12.8) (Table 1). Isolated CABG was the most common type of surgery (60%), followed by isolated valve (31%) and combined CABG + valve surgeries (10%). In patients under 40 years of age, the majority of patients (81/91, 89%) had isolated valve surgery, of which approximately half (n=38) had rheumatic heart disease (RHD) aetiology. All but 23 procedures were performed using cardiopulmonary bypass.

From the 1,630 study participants, 465 developed POAF with an overall incidence rate of 28.5% (Table 1). POAF incidence increased progressively with age (18.5% in patients aged less than 60 years, 28.5% in those aged 60–69 years, 35.7% in those aged 70–79 years and 44.3% in those aged older than 80 years). The highest incidence of POAF was seen after combined CABG+valve surgery (42.1%), followed by isolated valve surgery (30.7%) then isolated CABG (25.2%).

Statistically significant differences were observed between the POAF and no AF groups for age, ethnicity, weight, body mass index (BMI), obesity, hypertension, CHF, renal impairment, previous myocardial infarction, EuroSCORE II, type of surgery, and any aortic valve surgery. BMI and type of surgery were retained for the multivariable analysis as BMI was correlated with weight and obesity, while type of surgery was correlated with any aortic valve procedure.

Multivariable analysis

Only age, BMI, history of CHF, and type of surgery were independent predictors of POAF (Table 3.). There was no significant difference in risk of POAF between ethnic groups, and although the risk in Māori was high, it did not reach statistical significance (p=0.053, OR 1.46, 95%CI 0.99–2.14). The final multivariable model had a Hosmer–Lemeshow test p value of 0.35 and Nagelkerke's R^2 value of 0.11. The area under the ROC curve was 0.67 (95%CI 0.64–0.70), indicating suboptimal prognostic validity.

Subgroup analysis by ethnicity

The incidence of POAF was highest in Māori (35%) and NZ/Other European (32%) (Table 2). Valve procedures (including both isolated valve and CABG+valve surgeries) were more common in Māori than other ethnic groups (51% valvular heart surgery in Māori and 45% in NZ/Other European). Māori and Pasifika were younger and had high rates of comorbidities, including at least twice the rate of CHF (20.1% in Māori, 16.8% in Pasifika, 8.2% NZ/Other European). Māori and Pasifika who did develop POAF were approximately 10 years younger than NZ/Other Europeans (59.2+12.5 years Māori, 60.9+11.5 years Pasifika and 70.6+9.4 years NZ/European). Māori and Pasifika represented 85% of patients having valve surgery for RHD, with a mean age of 39 and 34 years for Māori and Pasifika respectively, compared to 65 years in NZ/Other Europeans with RHD.

Discussion

About one in four patients developed POAF, with the highest incidence in Māori, followed by NZ/Other European, then Pasifika and Indian ethnicities. Advanced age, increased BMI, history of CHF, and any valve surgery were the strongest predictors of POAF, but the predictive accuracy of these factors was modest at best, with the model successfully predicting 67% of cases.

Previous studies describe variable rates of POAF between 10 and 60% depending on the type of cardiac surgery, the duration and type of monitoring and the definition of AF used.[15] For example, lower rates of POAF are reported after isolated CABG compared to valve surgery, and continuous monitoring has identified higher rates of POAF compared to intermittent ECG monitoring.[16] The 29% incidence of POAF after CABG and valve surgeries identified in this New Zealand-based study is consistent with inpatient studies of similar design conducted internationally.[1,17] Procedure-specific POAF rates in our study are also similar, with rates of 25%, 31%, and 42% after isolated CABG, isolated valve, and combined CABG+valve surgeries respectively, comparable to the rates of 27–37% for the same surgery types in the Society of Thoracic Surgeons database.[18]

There are major and persistent ethnic disparities across most aspects of cardiovascular disease for Māori and Pasifika populations in New Zealand, including higher prevalence of cardiovascular risk factors and poorer access to appropriate interventions.[19] These disparities were observed in this study cohort, in which Māori and Pasifika presented with a high comorbidity burden at a young age. Māori had the highest overall incidence of POAF, but this may have been influenced by a higher proportion of valve surgeries. After adjusting for key risk factors, the risk of POAF in Māori was high, albeit not significantly higher, possibly

Table 1: Patient characteristics with and without new-onset atrial fibrillation. Figures are mean + standard deviation or number (percentage).

	Total (N=1630)	**No AF (N=1165)**	**AF (N=465)**	***p* value**
Demographic				
Age, years	63.5+12.8	62.1+13.1	67.2+11.2	**<0.001**
Age categorical				**<0.001**
<60 years	507 (31.1)	413 (35.5)	94 (20.2)	
60–69 years	536 (32.9)	383 (32.9)	153 (32.9)	
70–79 years	490 (30.1)	315 (27.0)	175 (37.6)	
>80 years	97 (6.0)	54 (4.6)	43 (9.2)	
Gender				**0.61**
Male	1227 (75.3)	873 (74.9)	354 (76.1)	
Female	403 (24.7)	292 (25.1)	111 (23.9)	
Ethnicity				**<0.001**
NZ and Other European	841 (51.6)	572 (49.1)	269 (57.8)	
Māori	174 (10.7)	113 (9.7)	61 (13.1)	
Pasifika	285 (17.5)	214 (18.4)	71 (15.3)	
Indian	166 (10.2)	134 (11.5)	32 (6.9)	
Other Asian	134 (8.2)	109 (9.5)	25 (5.4)	
All other	30 (1.8)	23 (2.0)	7 (1.5)	
Clinical characteristics				
Weight, kg	86.6+19.8	85.7+19.6	88.9+20.1	**0.03**
Body mass index, kg/m^2	29.6+5.9	29.4+5.8)	30.2+6.2	**0.01**
Obesity (BMI >29.9 kg/m2 or >31.9 Māori/ Pasifika)	617 (37.9)	416 (35.7)	195 (41.9)	**0.02**
Smoking				0.08
Never smoked	911 (55.9)	659 (56.6)	252 (54.2)	
Ex-smoker	522 (32.0)	356 (30.6)	166 (35.7)	
Current smoker	197 (12.1)	150 (12.9)	47 (10.1)	
Hypertension	1132 (69.4)	788 (67.6)	344 (74.0)	**0.01**
Hypercholesterolaemia	1162 (71.3)	827 (71.0)	335 (72.0)	0.72

Table 1 (continued): Patient characteristics with and without new-onset atrial fibrillation. Figures are mean + standard deviation or number (percentage).

	Total (N=1630)	No AF (N=1165)	AF (N=465)	*p* value
Peripheral vascular disease/arteriopathy	67 (4.1)	48 (4.1)	19 (4.1)	1.00
Pre-existing respiratory disease	104 (6.4)	72 (6.2)	32 (6.9)	0.65
LVEF (%)	54.1+10.6	54.25+10.5	53.85+11.0	0.50
History of CHF	180 (11.0)	104 (8.9)	76 (16.3)	**<0.001**
CHF with normal LVEF (>50%)	98 (6.0)	58 (5.0)	40 (8.6)	**0.01**
CHF on operative admission	101 (6.2)	62 (59.6)	39 (51.3)	0.29
CHA2DS2-VASc score	2.5+1.4	2.4+1.4	2.7+1.4	**0.002**
Cerebrovascular disease	103 (6.3)	72 (6.2)	31 (6.7)	0.74
Diabetes	539 (33.1)	402 (34.5)	137 (29.5)	0.051
Renal impairment				**<0.001**
Moderate	595 (36.5)	390 (33.5)	205 (44.1)	
Severe	143 (8.8)	100 (8.6)	43 (9.2)	
Previous myocardial infarction	572 (35.1)	427 (36.7)	145 (31.2)	**0.04**
Rheumatic heart disease	67 (4.1)	52 (4.5)	15 (3.2)	0.34
Preoperative arrhythmia (not AF)	63 (3.9)	43 (3.7)	20 (4.3)	0.57
Surgical characteristics				
Previous surgery with CPB	86 (5.3)	63 (5.4)	23 (5.0)	0.72
Cardiopulmonary bypass time, minutes*	99.0 (78.0–126.0)	99 (79–125)	100 (77–132)	0.37
Cross clamp time, minutes	75.88+36.3	75.11+35.0	77.8+29.2	0.20
EuroSCORE II*	1.69 (1.07–2.97)	1.63 (1.04–2.74)	1.96 (1.13–3.50)	**<0.001**
Type of surgery				**<0.001**
CABG	973 (59.7)	728 (62.5)	245 (52.7)	
Valve surgery	498 (30.6)	345 (29.6)	153 (32.9)	
CABG + valve	159 (9.8)	92 (7.9)	67 (14.4)	
Any aortic valve surgery	462 (28.3)	297 (25.5)	165 (35.5)	**<0.001**

Table 1 (continued): Patient characteristics with and without new-onset atrial fibrillation. Figures are mean + standard deviation or number (percentage).

	Total (N=1630)	No AF (N=1165)	AF (N=465)	*p* value
Any mitral valve surgery	219 (13.4)	159 (13.6)	60 (12.9)	0.75
Multi-valve surgery	78 (4.8)	59 (5.1)	19 (4.1)	0.44

LVEF—left ventricular ejection fraction
CHF—congestive heart failure
CABG—coronary artery bypass grafting.
* Median and interquartile range.

Table 2: Univariate and multivariate logistic regression of factors associated with new-onset atrial fibrillation after CABG and/or valve surgery.

	Univariate analysis			Multivariate analysis		
	OR	95% CI	*p* value	OR	95% CI	*p* value
Age, per year	1.04	1.06–1.21	**<0.001**	1.05	1.04–1.06	**<0.001**
Body mass index, kg/m^2	1.02	1.0–1.94	**0.01**	1.04	1.02–1.06	**0.003**
History of CHF	1.99	1.45–2.74	**<0.001**	2.08	1.47–2.95	**<0.001**
Type of surgery—CABG (ref)			**<0.001**			**0.01**
Valve only	1.32	1.04–1.67	**0.02**	1.51	1.16–1.95	**0.002**
CABG + valve	2.16	1.53–3.06	**<0.001**	1.59	1.11–2.28	**0.01**
Ethnicity—NZ and Other European (ref)			**<0.001**			0.06
Māori	1.15	0.81–1.62	0.43	1.46	0.99–2.14	0.053
Pasifika	0.71	0.52–0.96	**0.03**	0.98	0.69–1.39	0.91
Indian	0.51	0.34–0.77	**0.01**	0.70	0.46–1.08	0.11
Other Asian	0.49	0.31–0.77	**0.01**	0.66	0.41–1.07	0.10
Other	0.65	0.27–1.53	0.32	0.76	0.32–1.83	0.54
Hypertension	1.36	1.07–1.73	**0.01**	1.21	0.92–1.58	0.17
Renal impairment—none (ref)			**<0.001**			0.16
Moderate	1.64	1.30–2.05	**<0.001**	1.30	0.99–1.70	0.06

Table 2 (continued): Univariate and multivariate logistic regression of factors associated with new-onset atrial fibrillation after CABG and/or valve surgery.

	Univariate analysis			Multivariate analysis		
	OR	**95% CI**	***p* value**	**OR**	**95% CI**	***p* value**
Renal impairment—none (ref)			**<0.001**			0.16
Severe	1.34	0.91–2.0	0.14	1.10	0.69–1.65	0.69
Previous myocardial infarction	0.78	0.62–0.99	**0.04**	0.90	0.68–1.12	0.48
EuroSCORE II	1.04	1.01–1.07	**<0.001**	1.02	0.99–1.05	0.16

CHF—congestive heart failure
CABG—coronary artery bypass grafting

Table 3: Comparison of atrial fibrillation incidence and descriptive statistics between ethnic subgroups. Figures are mean + standard deviation or number (percentage) unless otherwise stated.

	NZ/Other European	Māori	Pasifika	Indian	Other Asian	Other
n (%)	841 (51.6)	174 (10.7)	285 (17.5)	166 (10.2)	134 (8.2)	30 (1.8)
POAF incidence % (95% CI)	32.0 (28.8–35.3)	35.1 (28.0–42.6)	24.9 (20.0–30.4)	19.3 (13.6–26.1)	18.7 (12.5–26.3)	23.3 (9.9–42.3)
Type of surgery						
Isolated CABG	463 (55.1)	86 (49.4)	170 (59.6)	137 (82.5)	97 (73.5)	20 (66.7)
Isolated valve	267 (31.7)	71 (40.8)	101 (35.4)	23 (13.9)	30 (22.7)	6 (20.0)
CABG + valve	111 (13.2)	17 (9.8)	14 (4.9)	6 (3.6)	5 (3.8)	4 (13.3)
Age, years	67.7+10.3	56.9+13.5	55.4+15.1	63.6+9.9	63.3+12.5	64.3+11.8
Age categorical						
< 60 years	160 (19.0)	89 (51.1)	156 (54.7)	49 (29.5)	42 (31.3)	11 (36.7)
60–69 years	272 (32.3)	59 (33.9)	79 (27.7)	74 (44.6)	45 (33.6)	7 (23.3)
70–79 years	336 (40.0)	23 (13.2)	49 (17.2)	34 (20.5)	37 (27.6)	11 (36.7)
> 80 years	73 (8.7)	3 (1.7)	1 (0.4)	9 (5.4)	10 (7.5)	1 (3.3)
BMI	28.8+5.3	33.7+6.0	33.2+6.6	26.8+3.9	25.4+3.3	28.6+4.6
LVEF	55.8+9.5	50.4+12.5	50.8+10.9	54+10.8	56.7+10.4	52.1+11.8

Table 3 (continued): Comparison of atrial fibrillation incidence and descriptive statistics between ethnic subgroups. Figures are mean + standard deviation or number (percentage) unless otherwise stated.

	NZ/Other European	Māori	Pasifika	Indian	Other Asian	Other
CHA2DS2-VASc	2.5+1.4	2.2+1.4	2.4+1.4	2.9+1.3	2.7+1.6	2.4+1.4
CHF	69 (8.2)	35 (20.1)	48 (16.8)	14 (8.4)	11 (8.2)	3 (10.0)
Diabetes	182 (21.6)	57 (32.8)	122 (42.8)	118 (71.1)	50 (37.3)	10 (33.3)
RHD	6 (0.7)	18 (10.3)	39 (13.7)	2 (1.2)	2 (1.5)	0
eGFR, mL/ min/1.73m^2	76+17	76+24	74+29	76+21	79+21	71+22
EuroSCORE II *	1.7 (1.1–2.9)	1.9 (1.2–3.6)	1.9 (1.2–3.7)	1.5 (0.9–2.5)	1.7 (1.0–2.8)	1.7 (0.9–4.3)

* Median and interquartile range.
POAF—post-operative atrial fibrillation
CABG—coronary artery bypass grafting
BMI—Body Mass Index
LVEF—left ventricular ejection fraction
CHF—congestive heart failure
RHD—rheumatic heart disease
eGFR—estimated glomerular filtration rate.

due to small numbers. Previously identified ethnic differences in POAF incidence have shown higher rates in Caucasian groups despite a higher prevalence of traditional risk factors in minority populations in the United States.[20,21] Ethnic differences in POAF susceptibility remain poorly understood, and exploration of genetic and other factors such as left atrial (LA) size may be useful.

The only consistently reported predictor of POAF is advanced age.[10] Ageing and age-related comorbidities are associated with progressive structural and electrical remodelling of the atrial substrate, and most studies show that the risk of POAF increases further per decade of life.[22] However, previous research has not agreed on definitive age thresholds to be used in risk stratification. A recently published clinical guideline for targeted POAF prevention includes patients over 75 years of age in a list of potential risk factors.[9] However, our results showed that Māori and Pasifika developed POAF approximately 10 years younger than NZ/Other Europeans, suggesting that guidelines need to consider different age structures for different ethnicities when making such recommendations.

The predictive accuracy of the presented risk model was only close to fair, a result shared with most studies attempting to identify patients at highest risk of POAF.[10] The only previous New Zealand study of POAF tested existing risk scores in patients after isolated CABG surgery and found that all models failed to accurately predict POAF (C-statistic <0.60).[23] Age, weight, and CHF were similarly identified as independent predictors, and our results suggest that these predictors may also be relevant after valve and combined CABG+valve procedures. However, these factors are unlikely to inform more targeted pharmacological prevention strategies due to their poor discrimination. While this study was not designed to examine the safest and most effective prevention strategy for POAF prevention, our results suggest that a blanket rather than targeted approach remains the most appropriate strategy despite recommendations for clinical risk stratification.[9] Risk assessment may be limited to informing monitoring protocols to quickly identify and respond to POAF and providing

education to patients about what to expect in the early post-operative period. Further research should focus on establishing how POAF translates to clinical outcomes in the New Zealand setting and investigating strategies that can reduce the associated morbidity and mortality in the short and longer term.

The strengths of this study include being the first New Zealand study to examine the incidence of POAF by ethnicity and among the most common types of cardiac surgery. The sample size was reasonably large and sufficiently powered to examine the effects of multiple variables identified from previous studies. However, the study is subject to several limitations. First, variable selection was limited to those collected as part of the registry database. Better predictive models may be obtained using variables that were not available in our study, for example LA size and preoperative medications, but would require prospective data collection in a large study. Second, the definition of POAF used may have missed asymptomatic AF or symptomatic AF occurring after discharge, although our definition was equivalent to that used in other international registries and therefore offers an accurate comparison of incidence. Third, the small subsample proportion for Māori prevented a more precise estimate of incidence in comparison to the other ethnic groups. Finally, participants in this study were routinely treated with prophylactic amiodarone after surgery, meaning that the POAF rates may be higher in groups not treated prophylactically and that the accuracy of the risk prediction model should only be applied to groups treated with prophylactic amiodarone.

Conclusions

The incidence of new-onset POAF after CABG and/or valve surgery in a New Zealand hospital is similar to international settings. Factors that independently increased POAF risk were advanced age, high BMI, history of CHF, and any valve surgery. However, the limited accuracy of models based on routinely collected data means risk stratification is unlikely to provide sufficiently targeted POAF prevention strategies. At best, risk stratification might be used to provide information to patients on expected perioperative risks or support monitoring for early detection and treatment of POAF.

COMPETING INTERESTS
Nil.

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