Renal dysfunction and the risk of postoperative atrial fibrillation after cardiac surgery: role beyond the CHA$_2$DS$_2$-VASc score

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Aims
To investigate whether renal dysfunction is a useful predictor of postoperative atrial fibrillation (POAF) after cardiac surgery. We also aimed to determine whether the addition of renal dysfunction into the scoring system could improve diagnostic accuracy of the CHA$_2$DS$_2$-VASc score to predict POAF.

Methods and results
The study prospectively enrolled 350 consecutive patients who underwent cardiac surgery. Echocardiography was performed before cardiac surgery. Renal dysfunction was defined as estimated glomerular filtration rate < 60 mL min$^{-1}$ 1.73 m$^{-2}$. All patients were monitored with continuous electrocardiographic telemetry for the occurrence of POAF until the day of hospital dismissal. Postoperative atrial fibrillation occurred in 103 of 350 patients (29%). Patients with POAF was associated with longer intensive care unit stay compared with those without POAF (3.7 ± 2.2 vs. 3.1 ± 1.4 days, $P = 0.002$). Both the CHA$_2$DS$_2$-VASc score and renal dysfunction were independent predictors of POAF in multivariate analysis. Renal dysfunction can further stratify patients with a CHA$_2$DS$_2$-VASc score of 0 or 1 into two groups with different POAF rates (3.1% vs. 68.8%, $P = 0.001$). A new scoring system (R-CHA$_2$DS$_2$-VASc score) derived by assigning an additional point representing renal dysfunction to the CHA$_2$DS$_2$-VASc score could improve its predictive accuracy. The area under the receiver operating characteristic curve increased from 0.68 to 0.71 ($P = 0.001$). Furthermore, the rate of left ventricular diastolic dysfunction also increased with increasing renal dysfunction.

Conclusion
Renal dysfunction, associated with left ventricular diastolic dysfunction, was a significant risk factor for POAF after cardiac surgery and may improve the diagnostic accuracy of the CHA$_2$DS$_2$-VASc score.

Keywords
Atrial fibrillation • CABG • Renal function • CHA$_2$DS$_2$-VASc

Introduction
Postoperative atrial fibrillation (POAF) is a major cause of morbidity and mortality after cardiac surgery. The literature reports that the rate of occurrence is 18–40%.$^{1–4}$ Consequently, considerable effort has been directed towards reduction of the risk of POAF, which is mainly focusing on pharmacological agents. However, most patients under cardiac surgery do not develop POAF and are exposed to high hospital costs and side effects of unnecessary prophylaxis.$^5$ In addition, it is critical that such antiarrhythmic approaches are implemented in all patients that undergo cardiac surgery. The safety and cost-effectiveness of these types of management towards improving patient outcomes have yet to be proven.$^5$

Therefore, it is important to identify patients who are at high risk of POAF and should receive routine antiarrhythmic therapy. Various clinical risk factors have been studied, including advanced age, body mass index, hypertension, obesity, and metabolic syndrome, have been associated with the occurrence of POAF after cardiac surgery.$^5,7$ However, there is no simple, convenience scoring system to predict the occurrence of POAF following cardiac surgery. Recently, the CHA$_2$DS$_2$-VASc score [congestive heart failure; hypertension; age ≥ 75 years (doubled); type 2 diabetes;
previous stroke, transient ischaemic attack (TIA), or thromboembolism (doubled); vascular disease; age 65–75 years; and sex category) by considering stroke risk factors in AF patients proved to be associated with risk of POAF and clinical outcome following cardiac surgery. However, the CHA2DS2-VASC scheme did not include renal dysfunction, which has been reported as an important risk factors for AF.† Therefore, the aim of this study was to investigate whether diagnostic accuracy of the CHA2DS2-VASC score for predicting POAF could be improved by adding renal dysfunction to the scoring system. Furthermore, we also aimed to determine whether the renal dysfunction is associated with left ventricular (LV) diastolic dysfunction in patients who underwent cardiac surgery.

Methods

Patient population
In this prospective study, we recruited 390 consecutive patients who underwent cardiac surgery in our institution between January 2008 and December 2012. The inclusion criteria were as follows: (1) presence of significant coronary artery disease with an indication for coronary artery bypass grafting; (2) presence of significant valvular heart disease (except mitral valve disease) requiring valve replacement or valvuloplasty; (3) the absence of mitral valve disease; (4) the absence of hemodialysis; (5) the absence of atrial fibrillation, paced rhythm, or any rhythm other than normal sinus rhythm; (6) the absence of history of AF; and (7) acceptable echocardiographic image quality. A total of 358 patients who met these criteria were included in the study. Following cardiac surgery, eight patients who received early antiarrhythmic drugs for ventricular arrhythmia were excluded from the study. Thus, 350 patients were enrolled in the study (mean age, 62 ± 10 years; 268 male).

Clinical reports, echocardiographic reports, and complete medical records were prospectively collected to investigate the relationships among renal function, diastolic function, and the risk of developing new-onset POAF after cardiac surgery. In addition, clinical diagnosis of diabetes, hypertension, hyperlipidemia, heart failure, and chronic obstructive pulmonary disease was recorded.

This study was approved by the institutional review board for human subjects at our institution, and the patients provided written informed consent before participating in the study.

Laboratory examination
Blood samples were collected before cardiac surgery, and hemoglobin and serum creatinine levels were measured. Anaemia was defined according to the National Kidney Foundation’s Kidney Dialysis Outcomes Quality Initiative (K/DOQI) recommendation, i.e. haemoglobin <11.0 g/dL (or hematocrit <33%) in premenopausal women and <12.0 g/dL (or hematocrit <37%) in adult men and postmenopausal women.

Renal dysfunction was defined as an eGFR of< 60 mL/min/1.73 m2. The estimated glomerular filtration rate (eGFR) was calculated using the Modification of Diet in Renal Disease Study (MDRD) formula: eGFR (mL/min/1.73 m2) = 186.3 × serum creatinine (mg/dL)−1.154 × age−0.203 (× 0.742 if female). The blood samples were drawn the day before the cardiac surgery for the measurement of serum creatinine. Renal dysfunction was defined as an eGFR of< 60 mL/min/1.73 m2.

Echocardiography
Echocardiography was performed by an experienced sonographer (S.K.C.) before the cardiac surgery. The diastolic measurements of left ventricular end diastolic diameter (LVEDD), interventricular septal wall thickness (IVSTd), and posterior wall thickness (PWTd) (in millimeters) were used to calculate LV mass (LVM) using the formula recommended by the American Society of Echocardiography:

LVM(g) = 0.81[1.04(LVEDD + IVSTd + PWTd)3 − (LVEDD)3]] + 0.6 g

The LV mass index (LVMi, g/m2) was defined as LVM normalized by body surface area. According to this formula, left ventricular hypertrophy (LVH) is defined as LVMi > 131 g/m2 in men and as > 100 g/m2 in women. Doppler echocardiography was performed to determine the early mitral inflow velocity (E), and tissue Doppler imaging (TDI) evaluation was performed to determine the medial mitral annulus velocity during passive filling (e').

Definition of left ventricular diastolic dysfunction
As recommended by the Heart Failure and Echocardiography Associations of European Society of Cardiology (ESC), both conventional and TDI echocardiographic techniques were used for diagnosis of diastolic dysfunction. In this study, the LV diastolic dysfunction diagnosis was made according to the criteria proposed by ESC. Left ventricular diastolic dysfunction was considered present if any of the following criteria were met: (1) E/e′ ≥ 15; (2) E/A < 0.5 and deceleration time (DT) > 280 ms; (3) left atrial volume index (LAVI) > 149 g/m2 (male) or >122 g/m2 (female); or (4) LAVI > 40 mL/m2.

Postoperative atrial fibrillation and outcome assessment
All patients were monitored with continuous electrocardiographic telemetry for the occurrence of POAF until the day of hospital dismissal. A standard 12 lead electrocardiogram was recorded in every patient suspected of an arrhythmic event. Postoperative atrial fibrillation was defined as any documentation of sustained AF episodes lasting > 30 seconds recorded by continuous telemetry throughout hospitalization or on electrocardiography at the outside of hospital setting within 30 days following cardiac surgery as described previously. The diagnosis of POAF was confirmed by an experienced cardiologist (H.M.L), who had no information about the renal function, echocardiographic features, and other parameters.

Statistics
Quantitative data are expressed as mean ± SD. Data were compared using two-sample t tests for independent samples. Differences in proportion were compared using a χ2 test or Fisher’s exact test, as appropriate. Analysis of variance was used to analyse the nonparametric data. P < 0.05 was considered statistically significant. Multivariate analysis with a logistic regression model was conducted to identify the baseline variables.
independently associated with new-onset POAF. The variables that were independently associated with POAF are presented as odds ratios (ORs) along with the 95% confidence intervals (CIs). A significant OR was obtained if the 95% CI exceeded 1 and a \( P < 0.05 \).

**Results**

**Clinical characteristics, postoperative atrial fibrillation rate, and predictors**

The mean age of the study population was 62 years (range, 29–86 years). There were 268 men (77%) and 82 women (23%). Out of 350 study patients, 78% had hypertension, 55% diabetes, 21% heart failure, 13% stroke, and 26% vascular disease (including 8% previous myocardial infarction, 5% peripheral arterial disease, and 14% carotid artery disease). Among these, 323 patients (92%) received coronary artery bypass surgery; 22 (6%) for valve procedure, including 20 aortic valve and two tricuspid valve replacement; three for concomitant coronary artery bypass surgery and valve procedures; and two (1%) for myxoma.

Of the 350 patients, 103 (29%) had new-onset POAF at a median of two days (range, 0–27 days) after cardiac surgery. The baseline clinical characteristics and medical treatment being received by the study population based on with and without POAF are shown in Table 1. The patients with POAF were older and had a significantly higher prevalence of hypertension, previous stroke or TIA, renal dysfunction, and vascular disease. The echocardiographic findings of the patients with POAF included larger left atrial size, greater LVMI, higher \( E/e' \) ratio, higher frequency of \( E/e' > 15 \), and more \( E/A < 0.5 \) and \( DT > 280 \) than did findings obtained from patients without POAF. Patients with POAF had higher rate of LV diastolic dysfunction (71.8% vs. 46.2%, \( P < 0.001 \)) compared with patients without POAF. There were no significant differences in gender, body mass index, diabetes mellitus, heart failure, pre-operative medication, LV EDV, LVM, and left ventricular ejection fraction between patients with and without POAF. The patients with POAF had higher \( \text{CHA}_2\text{DS}_2\text{-VASc} \) scores (3.6 ± 1.7 vs. 2.5 ± 1.5, \( P < 0.001 \)) than patients without POAF.

There were no significant differences between patients with and without POAF in surgical procedure type, rate of on or off-pump surgery, and duration of bypass or operation. Patients with POAF was associated with longer intensive care unit stay compared with those without POAF (3.7 ± 2.2 days vs. 3.1 ± 1.4 days, \( P = 0.002 \)). However, there were no significant differences between those with and without POAF in total hospital stay. There was a trend to have higher rate of morbidity, mortality, and morbidity or mortality in those with POAF compared with those without POAF; however, statically insignificant.

Significant predictors of POAF according to univariate regression analysis are shown in Table 2. Age, previous history of stroke or TIA, renal dysfunction, \( \text{CHA}_2\text{DS}_2\text{-VASc} \) score, LVH, \( E/e' > 15 \), \( E/A < 0.5 \), and \( ET > 280 \), and LV diastolic dysfunction were significantly associated with POAF. According to multivariate logistic regression analysis, renal dysfunction (OR: 2.60, 95% CI: 1.56–4.34, \( P < 0.001 \)), \( \text{CHA}_2\text{DS}_2\text{-VASc} \) (OR: 1.23, 95% CI: 1.02–1.49, \( P = 0.03 \)) and LV diastolic dysfunction (OR: 2.2, 95% CI: 1.26–3.68, \( P = 0.005 \)) remained independent predictors of POAF.

**Renal dysfunction and the prediction of postoperative atrial fibrillation**

A Kaplan–Meier survival analysis showed the patients with an eGFR < 60 mL/min/1.73 m² were associated with a higher POAF rate compared with patients with an eGFR of ≥ 60 mL/min/1.73 m² (Figure 1). Furthermore, among the 80 patients with a \( \text{CHA}_2\text{DS}_2\text{-VASc} \) score of 0 or 1, renal dysfunction (eGFR of < 60 mL/min/1.73 m²) could further stratify the patients into two groups with different POAF rates (3.1% vs. 68.8%, \( P < 0.001 \)), as shown in Figure 2.

**The new scoring system (R-\( \text{CHA}_2\text{DS}_2\text{-VASc} \) score) and postoperative atrial fibrillation rate**

The new scoring system (R-\( \text{CHA}_2\text{DS}_2\text{-VASc} \) score) was derived by adding one more point for renal dysfunction to the conventional \( \text{CHA}_2\text{DS}_2\text{-VASc} \) score. The POAF rates continuously increased as the scores became higher (Figure 3A). Furthermore, the new scoring system improved the diagnostic performance in predicting POAF, when compared with the \( \text{CHA}_2\text{DS}_2\text{-VASc} \) score alone. The area under the receiver operating characteristic curve increased from 0.68 to 0.71, and the difference was statistically significant (\( P < 0.001 \)), as shown in Figure 3B.

**The new R-\( \text{CHA}_2\text{DS}_2\text{-VASc} \) score and adverse cardiovascular events after cardiac surgery**

Post-surgical adverse cardiovascular events vs. \( \text{CHA}_2\text{DS}_2\text{-VASc} \) score and R-\( \text{CHA}_2\text{DS}_2\text{-VASc} \) score is summarized in Table 3. Patients with higher \( \text{CHA}_2\text{DS}_2\text{-VASc} \) or R-\( \text{CHA}_2\text{DS}_2\text{-VASc} \) score of at least 2 tended to have a higher morbidity, mortality, and higher morbidity or mortality rates, but statistically insignificant. The differences did not reach statistical significance, probably because of low event rate in this study.

**Renal dysfunction and diastolic dysfunction**

The preoperative echocardiographic hemodynamic parameters in the renal function groups are show in Figure 4. With decreasing renal function, however, the rate of LAVI > 40 mL/m², LVH, \( E/A < 5 \) and \( DT > 280 \), and \( E/e' > 15 \) increased. Also, as renal function decreased (from \( \text{group} > 60 \text{ mL/min/1.73 m²} \), 30–60 mL/min/1.73 m² to < 30 mL/min/1.73 m²), the rate of LV diastolic dysfunction (from 47%, 57% to 72%, \( P < 0.001 \)) and POAF (20%, 40%, to 49%, \( P < 0.001 \)) increased.

**Discussion**

**Major findings**

This study included a cohort of patients who underwent cardiac surgery for coronary artery disease or valvular disease. The main findings were as follows: (1) \( \text{CHA}_2\text{DS}_2\text{-VASc} \) score and renal dysfunction were associated with increased rate of POAF; (2) the accuracy of the \( \text{CHA}_2\text{DS}_2\text{-VASc} \) score in predicting POAF could be improved by adding renal dysfunction into the scoring system; and (3) decreased eGFR was associated with worse LV diastolic dysfunction.
Combining renal dysfunction and CHA2DS2-VASc score for predicting postoperative atrial fibrillation

Postoperative atrial fibrillation following cardiac surgery remained an important complication, resulting in prolonged hospital stay, increased risk of morbidity and mortality in a substantial number of patients.1 Most of the studies in the past had been great interest in preventing POAF with antiarrhythmic agents. However, routine pharmacological POAF prevention could expose 60–80% of patients to the side effects of antiarrhythmic agents for which there is no...
As a result, it is important to develop a scoring system to identify patients at higher risk of developing POAF and patients who should receive routine antiarrhythmic therapy. Therefore, development of risk prediction models to identify patients most likely to develop POAF is warranted.

Accordingly, efforts have been made to develop risk prediction models for identifying patients at risk of POAF following cardiac surgery. Recently, the CHA2DS2-VASc score also proved to be useful in predicting POAF and provided additional valuable information for risk stratification of patients with a CHADS2 score of 0 or 1.8 However, none of these previous scoring systems considered renal dysfunction. Our study is the first to demonstrate that the diagnostic accuracy of the CHA2DS2-VASc score in predicting POAF can be improved by adding renal dysfunction into the scoring system. As POAF prophylaxis has become increasingly popular, identifying patients who are at risk for POAF have become important issues.

In this study, the POAF rate was only 3.1% among patients with a CHA2DS2-VASc score of 0 or 1 and had an eGFR of ≥60 mL/min/1.73 m². Therefore, it may be safe to continue antiarrhythmic therapy in these patients. A further large-scale and prospective trial is necessary to confirm these findings.

Postoperative atrial fibrillation is associated with greater short-and long-term morbidity and mortality. Previous study showed oral anticoagulation therapy in patients with POAF was associated with 20% relative risk reduction of mortality. The relationship between anticoagulation therapy and decreased mortality in POAF patients suggests that a protective effect against thromboembolic stroke, which is the major cause of death attributable to AF. In this study, patients with higher CHA2DS2-VASc or R-CHA2DS2-VASc scores were associated with greater risk of new-onset POAF. These findings implicate that anticoagulation therapy should be considered for

### Table 2 Surgical procedure and post-surgical outcome of patients with and without postoperative atrial fibrillation

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Without POAF (n = 247)</th>
<th>With POAF (n = 103)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolate CABG</td>
<td>226 (91.5)</td>
<td>97 (94.2)</td>
<td></td>
</tr>
<tr>
<td>Valve procedures</td>
<td>17 (6.9)</td>
<td>5 (4.9)</td>
<td></td>
</tr>
<tr>
<td>Concomitant CABG and valve procedures</td>
<td>3 (1.2)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Myxoma</td>
<td>1 (0.4)</td>
<td>1 (1.0)</td>
<td></td>
</tr>
<tr>
<td>Bypass surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-pump surgery</td>
<td>174 (70.4)</td>
<td>73 (70.9)</td>
<td></td>
</tr>
<tr>
<td>Off-pump surgery</td>
<td>73 (29.6)</td>
<td>30 (29.1)</td>
<td></td>
</tr>
<tr>
<td>Duration of bypass, min</td>
<td>113.0 ± 58.6</td>
<td>121.0 ± 66.7</td>
<td>0.41</td>
</tr>
<tr>
<td>Duration of operation, min</td>
<td>276.8 ± 110.6</td>
<td>288.1 ± 105.7</td>
<td>0.58</td>
</tr>
<tr>
<td>Post-surgical outcome</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICU stay (days)</td>
<td>3.1 ± 1.4</td>
<td>3.7 ± 2.2</td>
<td>0.002</td>
</tr>
<tr>
<td>Total hospital stay (days)</td>
<td>19.2 ± 12.5</td>
<td>20.2 ± 8.4</td>
<td>0.52</td>
</tr>
<tr>
<td>Morbidity</td>
<td>31 (12.6)</td>
<td>18 (7.5)</td>
<td>0.24</td>
</tr>
<tr>
<td>Thromboembolic event</td>
<td>3 (1.2)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Ischaemic stroke or TIA</td>
<td>5 (2.0)</td>
<td>3 (2.9)</td>
<td></td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>0 (0)</td>
<td>2 (0.8)</td>
<td></td>
</tr>
<tr>
<td>Surgical wound bleeding or infection requiring reconstruction</td>
<td>17 (6.9)</td>
<td>13 (12.6)</td>
<td></td>
</tr>
<tr>
<td>Sepsis</td>
<td>7 (2.8)</td>
<td>3 (2.8)</td>
<td></td>
</tr>
<tr>
<td>Gastrointestinal bleeding</td>
<td>3 (1.2)</td>
<td>2 (1.9)</td>
<td></td>
</tr>
<tr>
<td>Mortality</td>
<td>7 (2.8)</td>
<td>3 (2.9)</td>
<td>1.0</td>
</tr>
<tr>
<td>Morbidity or mortality</td>
<td>31 (12.6)</td>
<td>21 (20.4)</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Values are presented as number (%) or mean ± SD. ICU, intensive care unit.
Figure 3  (A) Postoperative atrial fibrillation rate and the new score (R-CHA2DS2-VASc score). The new scoring system was derived from adding one additional point for renal dysfunction to the conventional CHA2DS2-VASc scores. The POAF rates continuously increased when the scores became higher.  (B) Receiver operating characteristic curves for the CHA2DS2-VASc scores and R-CHA2DS2-VASc score for predicting POAF. The new scoring model improved the diagnostic accuracy in predicting POAF when compared with the CHA2DS2-VASc score. The area under the ROC curve increased from 0.68 to 0.71 (P < 0.001). AUC, area under the curve.

Table 3  Post-surgical adverse cardiovascular events vs. CHA2DS2-VASc and R-CHA2DS2-VASc score

<table>
<thead>
<tr>
<th>CHA2DS2-VASc score</th>
<th>R-CHA2DS2-VASc score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2 (n = 80)</td>
<td>≥2 (n = 270)</td>
</tr>
<tr>
<td>POAF</td>
<td>13 (16.3)</td>
</tr>
<tr>
<td>Morbidity</td>
<td>3 (3.8)</td>
</tr>
<tr>
<td>Ischaemic stroke</td>
<td>3</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>0</td>
</tr>
<tr>
<td>Peripheral embolism</td>
<td>0</td>
</tr>
<tr>
<td>Mortality</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Morbidity or mortality</td>
<td>3 (3.8)</td>
</tr>
</tbody>
</table>

Data presented as n (%).

Figure 4  The rate of LVEF < 40%, LAVI > 40 mL/m², LVH, EA < 5, and DT > 280 ms, and E/e’ > 15, LV diastolic dysfunction and POAF as a function of renal function groups. Patients in advanced renal dysfunction were associated with increased LA size, rate of LVH, worse diastolic dysfunction and increased the risk of POAF.
patients with POAF, especially when they have high CHA₂DS₂-VASc or R-CHA₂DS₂-VASc score.

Potential mechanism responsible for the association between renal dysfunction and postoperative atrial fibrillation

Among the patients with less severe chronic kidney disease not undergoing hemodialysis, the prevalence of AF was similar to that in patients with end-stage renal disease. A recent study has demonstrated that the prevalence of AF gradually increases with decreasing GFR, which is unrelated to increasing age. These findings suggest that processes influencing the development of AF likely occur early in the course of the decline in the GFR.

The mechanisms by which renal dysfunction leads to AF are not completely understood, but increased likelihood of development of hypertension, fluid overload, pathological activation of the intrarenal renin–angiotension–aldosterone system with subsequent enhanced myocardial fibrosis. In this study, decreased GFR was associated with an increased degree of LVMI, LA size, and higher prevalence of diastolic dysfunction. It is well established that left atrial dilatation and stretch increase atrial vulnerability to the occurrence of atrial fibrillation, it has been reported that increasing LV diastolic dysfunction is strongly correlated with left atrial enlargement and stretch. An incremental deterioration of LV diastolic dysfunction is associated with left atrial and pulmonary vein dimension and pressure. Increased stretching increases the arrhythmogenic activity of the pulmonary veins. Furthermore, renal dysfunction has been reported to be associated with decreased conduction velocity, voltage, and increased size of left atrium. These findings suggest renal dysfunction was associated with both electrical and structural remodelling of LA, which possibly being the mechanism underlying the pathophysiology of new-onset POAF.

Limitations

There are several limitations of this study. There is heterogeneity of cardiac surgery type, although most of them was coronary-artery bypass graft (CABG), might lead to inconsistent information. To present a wider extrapolation of the study’s findings, we did not confine our analysis to isolated CABG surgery. However, we exclude those with presence of significant mitral valve disease with or without mitral valve surgery, which potentially could have affected results. Second, we did not include the patients with history of AF, which is the most important predictive variable. However, in consistent to the studies in the past, we excluded patients with history of AF in order to avoid referral bias. Third, we investigated POAF occurring within 30 days after cardiac surgery. Those with paroxysmal or asymptomatic AF could be missed if these events occurred outside of the hospital. The incidence of POAF in this study may therefore have been underestimated. However, the median period of onset of POAF in our study resembles the periods in previous study where POAF onset was typically observed within five days following cardiac surgery. Fourth, the number of events in patients with CHA₂DS₂-VASc score of 0 or 1 was small, and the usefulness of renal dysfunction for predicting POAF among these low-risk patients may not be conclusive on the basis of this study. However, it has been a universal problem of studies investigating POAF risk because low event rates in low-risk populations. A further large-scale and prospective trial is necessary to confirm these findings, especially to validate if renal dysfunction is useful for predicting POAF among patients with a CHA₂DS₂-VASc score of 0 or 1. Fifth, by using MDRD formula, calculation of GFR is greatly influenced by age, which is a risk factor for POAF. Therefore, it is possible that POAF occurred only because the patients were elderly.

Conclusion

Renal dysfunction, associated with diastolic dysfunction, presents significant risk factors for POAF after cardiac surgery independent from the CHA₂DS₂-VASc score. Renal dysfunction may improve the diagnostic performance of the CHA₂DS₂-VASc score for predicting POAF in cardiac surgery patients.

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Conflict of interest: none declared.

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Catheter ablation of idiopathic ventricular ectopy in the vicinity of the His bundle under the septal leaflet of the tricuspid valve

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A 59-year-old female with frequent, drug-refractory ventricular premature beats (VPBs) was referred for catheter ablation. On her resting ECG, monomorphic VPBs were present in bigeminal pattern with axis similar to sinus rhythm, transition zone in lead V3 and slurring in lead III, V2, and V3 (Panel A). During the procedure, the earliest ventricular activation site was localized just below the His bundle and preceded the onset of the QRS by 36 ms. To avoid damage to the AV node, the ablation catheter was manoeuvred with the support of a steerable sheath (Agilis, St Jude Medical) under the septal leaflet of the tricuspid valve with navigation by fluoroscopy (Panel B) and intracardiac echocardiography. Radiofrequency ablation (25 W, 60 s) at the site of earliest activation resulted in complete elimination of the VPBs.

This case report describes a novel technique of catheter ablation of VPBs in the vicinity of the His bundle. Positioning the ablation catheter under the septal leaflet of the tricuspid valve led both to a stable position and provided protection of the AV node during radiofrequency energy delivery by the tricuspid anulus.

The full-length version of this report can be viewed at: http://www.escardio.org/Guidelines-&-Education/E%2E%2F%20Learning/Electrophysiology/EP-Case-Reports.

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