Radiofrequency Catheter Ablation of Persistent Atrial Fibrillation Decreases a Sleep-Disordered Breathing Parameter During a Short Follow-up Period

Yoshihisa Naruse, MD; Hiroshi Tada, MD; Makoto Satoh, MD; Mariko Yanagihara, MD; Hidekazu Tsuneoka, MD; Yumi Hirata, PhD; Takeshi Machino, MD; Hiro Yamasaki, MD; Miyako Igarashi, MD; Kenji Kuroki, MD; Yoko Ito, MD; Yukio Sekiguchi, MD; Kazutaka Aonuma, MD

**Background:** Obstructive sleep apnea (OSA) is often associated with atrial fibrillation (AF), but the impact of radiofrequency catheter ablation (RFCA) for AF on sleep apnea syndrome is unknown.

**Methods and Results:** A total of 25 patients (3 women; 61±6 years) with sleep apnea syndrome who underwent RFCA for drug-refractory, persistent AF were studied. Polysomnography was also performed 1 day before and 1 week after RFCA in all patients. The total number of central or OSA or hypopnea events was analyzed and compared. Among the 25 patients who all predominantly had obstructive apnea, the apnea-hypopnea index (AHI; median, 21, interquartile range [IQR]: 11–38 to median 15, IQR: 7–23; P=0.002) and obstructive type of apnea (median 10, IQR: 6–19 to median 7, IQR: 2–14; P=0.003) decreased after RFCA. In patients in whom sinus rhythm was restored and maintained after RFCA, the AHI decreased after RFCA (median 22, IQR: 15–38 to median 15, IQR: 7–23; P<0.01), but it did not in those who had AF recurrence (median 10, IQR: 9–11 to median 11, IQR: 10–16; P<0.05). There was a significant correlation between the outcome of RFCA and % change in the AHI (rs=0.569, P=0.003).

**Conclusions:** In patients with sleep apnea syndrome and AF, restoring sinus rhythm by RFCA was significantly associated with a decrease in AHI (Clinical Trial Registration: Trial number, UMIN000005538). (Circ J 2012; 76: 2096–2103)

**Key Words:** Atrial fibrillation; Catheter ablation; Sleep apnea syndrome

Obstructive sleep apnea (OSA) is a common but often undiagnosed disorder associated with substantial cardiovascular morbidity and mortality. OSA and atrial fibrillation (AF) share many risk factors and comorbidities, including male gender, hypertension, congestive heart failure, and coronary artery disease. Approximately half of the patients with AF are likely to have OSA. The presence of sleep apnea has been shown to predict predischARGE AF after coronary bypass surgery. Furthermore, untreated OSA doubles the risk of a recurrence of AF after electrical cardioversion, and treatment of OSA with continuous positive airway pressure attenuates that risk. Patients with OSA are less likely to remain in sinus rhythm after radiofrequency catheter ablation (RFCA) of AF. Recently, we encountered some patients who had received RFCA in order to reduce the incidence of AF and who reported an improvement in their snoring after RFCA. A previous case report showed that the patient who had received cardioversion in order to restore AF to sinus rhythm reported a reduction in breathing disorders after the cardioversion. Therefore, we hypothesized that AF termination and restoration of sinus rhythm by RFCA might improve sleep apnea. This has not previously been investigated, therefore the present study was undertaken to clarify this point.

**Methods**

**Study Protocol**
A total of 59 consecutive patients with drug-refractory, persistent AF (7 women, 52 men; mean age, 61±7 years) who underwent RFCA between August 2009 and March 2010 were...
enrolled prospectively. Patients with problems related to sleep-disordered breathing, such as snoring, daytime sleepiness, frequent arousals at night, sleep apnea, or some combination of these symptoms were asked to undergo polysomnography in a sleep laboratory. All patients underwent polysomnography 1 day before and 1 week after RFCA to evaluate the short-term effect of RFCA on sleep-disordered breathing. The total duration and number of central or OSA or hypopnea episodes were analyzed and compared. The subjects also underwent laboratory tests and echocardiography 1 day before and 1 week after RFCA.

Medications were continued with no change in the amount until the end of the study period. The demographic and clinical data were analyzed. Ethics approval was obtained from the institutional review committee, and all patients gave their informed, written consent before participation.

Polysomnography

The sleep evaluations were conducted by a sleep specialist blinded to patient data at the Tsukuba University Hospital sleep disorder center. All patients had undergone standard sleep investigations: electroencephalography, electro-oculography, electromyography, electrocardiography, thoracoabdominal excursions, pulse oximetry, and naso-oral airflow with attended polysomnography as previously described. Apnea was defined as the cessation of inspiration for ≥10 s. All such events were counted irrespective of the degree of oxygen desaturation or presence of arousal. Obstructive apnea was defined as the absence of airflow in the presence of rib cage and/or abdominal excursions. Central apnea was defined as the absence of rib cage and abdominal excursions with the absence of airflow. Hypopnea was defined as reduction in the airflow ≥50% with a decrease in oxygen saturation (SaO2) ≥4% for ≥10 s in the presence of thoracoabdominal ventilator effort. The apnea-hypopnea index (AHI) was calculated as the sum of the apneic and hypopneic events per hour of sleep. The diagnosis of OSA required an AHI ≥5/h, with ≥50% of the events determined to be obstructive rather than central. We used AHI=5/h as the threshold. Mild sleep-disordered breathing was defined as AHI ≥5/h and <15/h, moderate sleep disordered breathing was defined as AHI ≥15 and <30/h, and severe sleep disordered breathing was defined as AHI ≥30/h. The % change in AHI was calculated as follows: (AHI at baseline−AHI after RFCA)/AHI at baseline) (%).

RFCA

All anti-arrhythmic medications were discontinued for 5 half-lives before the procedure, except for amiodarone, which was discontinued for at least 6 weeks. All patients received warfarin with a target international normalized ratio (INR) of 2.0–3.0. Dose-adjusted warfarin (INR >2.0) had been maintained for at least 1 month before RFCA in all patients. Therapeutic anti-coagulation was maintained with i.v. heparin following the discontinuation of warfarin 2 days prior to the intervention. Trans-esophageal echocardiography was performed within 24 h of the procedure to exclude any left atrial thrombi.

Extensive encircling pulmonary vein isolation (PVI) was performed using a double-lasso technique as previously described. After a trans-septal catheterization, two 7-Fr circular catheters (Lasso®; Biosense Webster, Diamond Bar, CA, USA) and a 7-Fr quadripolar, open irrigation catheter with a 3.5-mm distal electrode (Thermocool®, Biosense Webster) were introduced into the left atrium. After selective PV angiography, the 2 ring catheters were then positioned inside the ipsilateral PV ostia for the mapping of the PV potentials. Radiofrequency energy was delivered using the power control mode with a target power output of 20–35 W and maximum temperature of 42°C.

The endpoint of the extensive PVI was the creation of extensive ipsilateral bidirectional conduction block between the atrium and PVs, which was confirmed at least 60 min after successful PVI. If AF was sustained after the PVI, additional ablation, consisting of a linear ablation of the left atrial roof, superior vena cava isolation, and/or ablation of complex fractionated atrial electrograms, was performed. If the AF did not terminate after that additional ablation, sinus rhythm was restored by transthoracic cardioversion. A cavo-tricuspid isthmus ablation line was also created in all patients with confirmation of bidirectional conduction block.

I.v. heparin was given to maintain an activated clotting time of 300–400 s during the procedure. Warfarin was restarted on the next day of the procedure and effective anti-coagulation was maintained with heparin until the INR was ≥1.6. Warfarin with a maintenance dose (INR 2.0–3.0) was continued for at least 3 months after RFCA in all patients.

Echocardiography

Standard echocardiography was performed 1 day before and 1 week after RFCA with a Vivid-7TM (General Electric-Vingmed, Milwaukee, WI, USA) or ARTIDA®TM (Toshiba Medical Systems, Tochigi, Japan). M-mode images were obtained from the parasternal long-axis views for a quantitative assessment of the left ventricular dimensions and left ventricular ejection fraction. The left atrium volume was measured with a planimeter from the apical 4- and 2-chamber views. Estimation of the right ventricular systolic pressure was obtained with the tricuspid regurgitant jet. The estimated pulmonary capillary wedge pressure (PCWP) was calculated using the regression equation PCWP=1.91+(1.24×E/E’), where E is the transmitted mitral E wave velocity and E’ is the mitral annular early diastolic velocity.

Other Measurements

The plasma level of the N-terminal pro B-type natriuretic peptide (NT-pro-BNP) was measured 1 day before and 1 week after RFCA using a commercially available electrochemiluminescence immunoassay based on a polyclonal antibody-based sandwich chemiluminescence assay (Roche Diagnostics, Germany) using an autoanalyzer. The normal NT-pro-BNP range of a healthy population is <125 pg/ml, with a lowest detection limit of <5 pg/ml. We also calculated estimated glomerular filtration rate (eGFR) using the equation established by the Japanese Society of Nephrology for Japanese subjects: eGFR (ml·min⁻¹·1.73 m⁻²)=194×[serum creatinine (mg/dl)]⁻¹.094×(age)⁻0.287×(0.739 if female).

Statistical Analysis

Continuous variables are expressed as mean±SD. Non-normally distributed data are expressed as median (interquartile range [IQR]). Because of the limited sample size, serial polysomnography recordings and clinical factors were compared using a Wilcoxon’s signed rank test for paired variables. Non-parametric Mann-Whitney U-test was used to test for statistically significant differences in the continuous variables between the kinds of breathing events and between the successful RFCA group and failed RFCA group. Categorical variables were compared using chi-square test or Fisher’s exact test to detect differences. Spearman coefficients were used to evaluate the correlation between the % change in the AHI and other parameters. All analyses were performed using PASW 17.0.
Results

Subjects

Of these 59 patients, 33 patients had problems related to sleep-disordered breathing, such as snoring, daytime sleepiness, frequent arousals at night, sleep apnea, or some combination of these symptoms and they were asked to undergo polysomnography in a sleep laboratory. Of these 33 patients, 27 provided written informed consent, and in 25 of them, polysomnography showed sleep-disordered breathing. These 25 patients (3 women; mean age, 61±6 years) were enrolled in further test. The remaining 2 patients who underwent polysomnography 1 day before and 1 week after RFCA and who were not diag-

### Table 1. Subject Characteristics vs. Outcome of RFCA

<table>
<thead>
<tr>
<th></th>
<th>All (n=25)</th>
<th>Successful RFCA (n=20)</th>
<th>Failed RFCA (n=5)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>61±6</td>
<td>61±6</td>
<td>62±4</td>
<td>0.668</td>
</tr>
<tr>
<td>Male gender</td>
<td>22 (88)</td>
<td>18 (90)</td>
<td>4 (80)</td>
<td>0.504</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>25.1±3.2</td>
<td>24.9±3.3</td>
<td>26.1±3.0</td>
<td>0.575</td>
</tr>
<tr>
<td>Total duration of AF history (years)</td>
<td>6.1 [4.0–9.3]</td>
<td>6.0 [4.0–11.5]</td>
<td>8.0 [5.4–8.1]</td>
<td>0.945</td>
</tr>
<tr>
<td>Total duration of sustained AF (years)</td>
<td>1.0 [0.5–5.3]</td>
<td>1.0 (0.4–2.3)</td>
<td>6.7 [4.9–8.4]</td>
<td>0.018</td>
</tr>
<tr>
<td>Hypertension</td>
<td>13 (52)</td>
<td>10 (50)</td>
<td>3 (60)</td>
<td>1.000</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>16 (64)</td>
<td>12 (60)</td>
<td>4 (80)</td>
<td>0.621</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>8 (32)</td>
<td>6 (30)</td>
<td>2 (40)</td>
<td>1.000</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>6 (24)</td>
<td>5 (25)</td>
<td>1 (20)</td>
<td>1.000</td>
</tr>
<tr>
<td>Structural heart disease</td>
<td>1 (4)</td>
<td>1 (5)</td>
<td>0 (0)</td>
<td>1.000</td>
</tr>
<tr>
<td>Total no. AADs used previously</td>
<td>3.0±1.0</td>
<td>2.9±0.9</td>
<td>3.6±1.1</td>
<td>0.169</td>
</tr>
<tr>
<td>Class I</td>
<td>12 (48)</td>
<td>9 (45)</td>
<td>3 (60)</td>
<td>0.645</td>
</tr>
<tr>
<td>Class III</td>
<td>10 (40)</td>
<td>8 (40)</td>
<td>2 (40)</td>
<td>1.000</td>
</tr>
<tr>
<td>ACEI/ARB</td>
<td>10 (40)</td>
<td>8 (40)</td>
<td>2 (40)</td>
<td>1.000</td>
</tr>
<tr>
<td>β-blockers</td>
<td>13 (52)</td>
<td>9 (45)</td>
<td>4 (80)</td>
<td>0.322</td>
</tr>
<tr>
<td>Digitalis</td>
<td>4 (16)</td>
<td>4 (20)</td>
<td>0 (0)</td>
<td>0.549</td>
</tr>
<tr>
<td>Sleep medication</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Data given as mean±SD, median (IQR), or n (%).

RFCA, radiofrequency catheter ablation; AF, atrial fibrillation; AAD, anti-arrhythmic drug; ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; IQR, interquartile range.

![Figure 1](image-url)  

Severity of sleep-disordered breathing (SDB) before and after radiofrequency catheter ablation (RFCA) for atrial fibrillation. (●) Successful RFCA; (○) failed RFCA. Mild SDB, apnea-hypopnea index (AHI) ≥5/h and <15/h; moderate SDB, AHI ≥15/h and <30/h; severe SDB, AHI ≥30/h.

(SPPS, Chicago, IL, USA). P<0.05 was considered statistically significant.
nosed with sleep-disordered breathing on baseline polysomnography were considered as the control subjects, even though the number was very small.

RFCA
RFCA was successfully performed in all patients, and no major complications (eg, stroke, atrio-esophageal fistula, PV stenosis) occurred in any of the patients during the procedure. Of 25 patients, 5 failed to maintain sinus rhythm and an AF recurrence was recorded at the second polysomnographic recording. These 5 patients were defined as the failed RFCA group compared with the remaining 20 patients in the successful RFCA group.

Demographic and Clinical Characteristics
Baseline subject characteristics are summarized in Table 1. Mean body mass index (BMI) was 25.1±3.2 kg/m². Twelve and 2 patients were diagnosed as being overweight (BMI ≥25) and obese (BMI ≥30), respectively. All patients had a history of unsuccessful treatment with at least ≥2 anti-arrhythmic drugs. No patients received any sleep medication or diuretics. None had a history of previous ablation for AF.

There was no significant difference in the age, gender, BMI, comorbid disease, or medications between the 2 groups. The total duration of sustained AF was significantly longer in the failed RFCA group than in the successful RFCA group (P<0.05; Table 1).

Baseline Polysomnography and Other Measurements
The median AHI at baseline was 21 (IQR: 11–38). The severity of the sleep-disordered breathing was mild in 9 patients (36%), moderate in another 8 (32%), and severe in the remaining 8 (32%; Figure 1). Fifteen patients (60%) presented with episodes of both obstructive and central apnea. All patients had apnea that was predominantly obstructive. Mean total sleep time at baseline polysomnography was 327±102 min, and the median arousal index at baseline was 37 (IQR: 27–48). The mean heart rate and systolic blood pressure were 77±17 beats/min and 120±13 mmHg, respectively.

There was no significant difference in the breathing events, total sleep time, oxyhemoglobin saturation, vital signs, laboratory tests, and echocardiographic parameters at baseline between the successful and failed RFCA groups (Table 2).

Polysomnography and Other Measurements After RFCA
The AHI decreased significantly after RFCA (baseline, 21, IQR: 11–38; after RFCA, 15, IQR: 7–23; P<0.01). The obstructive apnea index (OAI) also decreased significantly after RFCA (baseline, 10, IQR: 6–19; after RFCA, 7, IQR: 2–14; P<0.01). There was a significant positive correlation between the % change in AHI and % change in OAI (rs=0.73, P<0.001; Figure 2A), but there was no significant difference in the number of central type apnea or hypopnea events (0.3, IQR: 0.0–0.6 to 0.2, IQR: 0.0–0.8; P=0.6, 6, IQR: 2–8 to 5, IQR: 2–8; P=0.6, respectively). Although the change in the median AHI was 21 to 15, which was within the moderate range of the AHI, the severity of the sleep-disorder breathing improved after RFCA in 10 patients (40%; Figure 1). Furthermore, the sleep-disorder breathing normalized after RFCA in 2 patients (8%; Figure 1). In contrast, the AHI did not differ between the baseline and

Table 2. Change in Sleep Apnea Parameters and Clinical Characteristics vs. Outcome of RFCA

<table>
<thead>
<tr>
<th>Breathing events (no. episodes/h)</th>
<th>Successful RFCA (n=20)</th>
<th>Failed RFCA (n=5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>After RFCA</td>
</tr>
<tr>
<td>AHI</td>
<td>22 (15–38)</td>
<td>15 (7–23)</td>
</tr>
<tr>
<td>Obstructive apnea index</td>
<td>13 (7–19)</td>
<td>6 (2–15)</td>
</tr>
<tr>
<td>Central apnea index</td>
<td>0.2 (0.0–0.5)</td>
<td>0.3 (0.2–0.9)</td>
</tr>
<tr>
<td>Hypopnea index</td>
<td>7 (3–12)</td>
<td>5 (2–9)</td>
</tr>
<tr>
<td>Arousal due to disordered breathing</td>
<td>36 (27–45)</td>
<td>28 (22–34)</td>
</tr>
<tr>
<td>Total sleep time (min)</td>
<td>327±108</td>
<td>338±74</td>
</tr>
</tbody>
</table>

Oxyhemoglobin saturation
- Base line (%) | 95±1 | 95±1 | 95±2 | 95±1 |
- Lowest value (%) | 83±4 | 84±5 | 80±11 | 81±11 |
- <90% (% of total sleep time) | 6±2 | 5±2 | 5±4 | 5±3 |

Vital signs
- Heart rate (beats/min) | 77±18 | 66±9 | 80±11 | 81±9 |
- SBP (mmHg) | 119±13 | 113±10* | 122±15 | 116±13 |
- Body weight (kg) | 70.0±11.4 | 68.8±10.9 | 72.8±9.4 | 72.8±9.9 |
- eGFR (ml·min⁻¹·1.73 m⁻²) | 74±18 | 75±14 | 71±15 | 61±10 |

Echocardiography parameters
- Left atrial volume (ml) | 62±23 | 52±14* | 75±16 | 78±15 |
- LV ejection fraction (%) | 65±10 | 65±8 | 64±7 | 62±16 |
- RV pressure (mmHg) | 24±5 | 21±5 | 26±4 | 29±5 |
- Estimated PCWP (mmHg) | 13±4 | 11±3* | 12±3 | 12±3 |

Data given as mean±SD, median (IQR), or n (%).
*P<0.05 and †P<0.01 vs. baseline.
AHI, apnea-hypopnea index; SBP, systolic blood pressure; NT-pro-BNP, N-terminal pro B-type natriuretic peptide; eGFR, estimated glomerular filtration rate; LV, left ventricular; RV, right ventricular; PCWP, pulmonary capillary wedge pressure. Other abbreviations as in Table 1.
Figure 2. Correlation between % change in the apnea-hypopnea index other parameters using Spearman coefficients. (●) Successful radiofrequency catheter ablation (RFCA); (○) failed RFCA. NT-pro-BNP, N-terminal pro B-type natriuretic peptide; PCWP, pulmonary capillary wedge pressure.
Figure 3. The % change in vital signs, laboratory tests, and echocardiographic parameters between the successful and failed radiofrequency catheter ablation (RFCA) groups. NT-pro-BNP, N-terminal pro B-type natriuretic peptide; PCWP, pulmonary capillary wedge pressure; RV, right ventricular.
post-RFCA polysomnography in the 2 patients who had no sleep-disordered breathing on baseline polysomnography (AHI, 0.3/h to 1.0/h; and AHI, 3.2/h to 2.4/h).

The heart rate (77±17 beats/min to 69±11 beats/min; P<0.05), systolic blood pressure (120±13 mmHg to 114±10 mmHg; P<0.05), body weight (70.6±10.9 kg to 69.5±10.5 kg; P<0.001), and plasma NT-pro-BNP level (372 pg/ml, IQR: 208–603 pg/ml to 119 pg/ml, IQR: 84–182 pg/ml; P<0.01) decreased significantly after RFCA. The left atrial volume (65±22 ml to 57±17 ml; P<0.05) and estimated PCWP (13±4 mmHg to 11±3 mmHg; P<0.01) also decreased significantly after RFCA.

**Correlation Between Change in AHI and Other Parameters**

There was a significant correlation between the % change in AHI and outcome of RFCA (rs=0.57, P<0.01; Figure 2B). In 20 of 25 patients in whom sinus rhythm could be restored and maintained after RFCA (successful RFCA group), the AHI decreased after RFCA (P<0.01; Table 2). In those patients, the % median change in the AHI was 44% (IQR: 24–60), and it was >50% in 9 patients (45%; Figure 2B). There were also significant decreases in OAI (P<0.01), arousal (P<0.01), time on oxyhemoglobin saturation level <90% (P<0.01), heart rate (P<0.01), systolic blood pressure (P<0.05), body weight (P<0.01), plasma NT-pro-BNP level (P<0.01), left atrial volume (P<0.05), and estimated PCWP (P<0.01) after RFCA in those patients (Table 2).

In contrast, in the remaining 5 patients who failed to maintain sinus rhythm after RFCA (failed RFCA group), the AHI increased (P<0.05; Table 2). There were no significant changes in the other breathing events, total sleep time, oxyhemoglobin saturation, vital signs, laboratory tests, and echocardiographic parameters between baseline and after RFCA in the failed RFCA group (Table 2).

There was no significant correlation between % change in AHI and % change in left atrial volume (rs=0.19, P=0.4; Figure 2C). There was a significant correlation, however, between % change in AHI and % change in body weight (rs=0.70, P<0.001; Figure 2D), plasma NT-pro-BNP level (rs=0.65, P<0.001; Figure 2E), and estimated PCWP (rs=0.47, P<0.05; Figure 2F).

**Impact of Successful RFCA on the Other Parameters**

There was no significant difference in % change in left atrial volume (P=0.37; Figure 3A), left ventricular ejection fraction (P=0.79), and blood pressure (P=0.77) between the successful and failed RFCA groups. The % change in right ventricular pressure (P=0.05; Figure 3B) and NT-pro-BNP (P=0.05; Figure 3C), however, tended to be greater in the successful RFCA group than in the failed RFCA group. Furthermore, the % change in heart rate, body weight, and PCWP were all greater in the successful RFCA group than in the failed RFCA group (all for P<0.05; Figures 3D–F).

**Discussion**

**Major Findings**

The present findings were as follows: (1) among 25 patients who all predominantly had OSA, the AHI and OAI improved after RFCA for AF; (2) a decrease in AHI and OAI was not achieved in the failed RFCA group, but was achieved in the successful RFCA group; (3) % change in body weight, plasma NT-pro-BNP level, and estimated PCWP were correlated with % change in AHI; and (4) % change in heart rate, body weight, and PCWP was greater in the successful RFCA group than in the failed RFCA group.

**Hemodynamic Consequences of AF**

AF can lead to a fall in cardiac output that is often clinically significant. Potential consequences include a fall in blood pressure, decreased exercise capacity, and pulmonary congestion, all of which are manifestations of heart failure. In addition, AF and heart failure often occur together, and each may predispose to the other. Multi-factorial physiological factors such as rapid ventricular rate, irregular rhythm, and loss of atrial systole may contribute to the adverse hemodynamic changes in AF. In the present study, the % change in the NT-pro-BNP and right ventricular pressure tended to be greater, and the % change in heart rate, body weight, and PCWP was greater in the successful RFCA group than in the failed RFCA group. These results indicate that RFCA to restore sinus rhythm may improve the hemodynamics.

**Proposed Mechanism of the Decreasing of AHI and OAI by RFCA for Restoration of Sinus Rhythm**

OSA is caused mainly by the presence of excessive soft tissue (ie, soft palate, tonsils, and base of the tongue) or by hypotonia of the pharyngeal muscles during sleep. Furthermore, previous studies suggested a unifying concept that overnight rostral fluid displacement from the legs and increased airway congestion contribute to the pathogenesis of OSA in patients both with and without heart failure. The amount of fluid displaced from the legs overnight correlated strongly with an overnight increase in neck circumference and AHI in men without heart failure. Diuresis was accompanied by attenuation of OSA and increased pharyngeal caliber in patients with diastolic heart failure and OSA, and conversion from nocturnal to continuous peritoneal dialysis was accompanied by a worsening of OSA and increased airway congestion with a lower fluid removal during the night in patients with renal failure.

It was hypothesized that reduced airway congestion due to restoration of sinus rhythm by RFCA would decrease the AHI and OAI. The present data showed that the % change in the AHI was significantly correlated with the outcome of RFCA and % change in body weight, estimated PCWP, and plasma NT-pro-BNP level. The decrease in body weight, estimated PCWP, and plasma NT-pro-BNP level might indirectly indicate decrease in fluid volume and airway congestion. These facts support this hypothesis.

**Clinical Implications**

In the present study, approximately 40% of the patients who underwent RFCA for AF had OSA. This indicates that concomitant OSA is not rare in candidates for RFCA of AF. Close attention should be paid to concomitant OSA in patients with AF.

Because the restoration of sinus rhythm on RFCA improved the severity of sleep-disordered breathing in approximately half of the patients, polysomnography should be conducted after RFCA for AF to avoid overestimating the severity of sleep-disordered breathing due to the coexistence of AF. We observed, however, a normalization of sleep-disordered breathing in only 2 patients. Thus, in the present patients with AF, RFCA for AF could not be considered as an alternative to continuous positive airway pressure treatment.
eral ablation may contribute to the decrease in AHI. Second, we did not measure the change in leg fluid volume and neck circumference before and after polysomnography, and the mechanisms of the AHI decrease achieved on RFCA remain unclear; thus, further studies are needed to elucidate the mechanisms involved in the achievement of these reductions.

**Conclusion**

In patients with OSA and AF, restoring sinus rhythm by RFCA significantly decreases AHI and OAI during a short follow-up period.

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**Disclosures**

No author has a real or perceived conflict of interest.

**References**