International Journal of Cardiology 260 (2018) 99–102

Contents lists available at ScienceDirect

International Journal of Cardiology

journal homepage: www.elsevier.com/locate/ijcard

Short communication

Prevalence and clinical characteristics of obstructive- and central-dominant sleep apnea in candidates of catheter ablation for atrial fibrillation in Japan

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ARTICLE INFO

Article history:
Received 4 January 2017
Received in revised form 5 January 2018
Accepted 22 January 2018

Keywords:
Atrial fibrillation
Sleep apnea
Obstructive sleep apnea
Central sleep apnea
Portable polygraphy

ABSTRACT

Introduction: We aimed to study the prevalence and types of sleep apnea (SA) as well as their clinical characteristics in atrial fibrillation (AF) ablation candidates in Japan.
Methods: Before catheter ablation, 197 consecutive AF patients (age: 60 ± 9 years, body mass index; 25.0 ± 3.0) were evaluated with portable polygraphy. We compared the clinical characteristics, according to the severity of SA as well as its types, as defined by the presence of obstruction and the mixed vs. central apnea indices.
Results: The mean apnea–hypopnea index (AHI) was 17.7 ± 11.9, with 135 AF patients having an AHI ≥10 (68.5%). Patients with an AHI ≥10 had a significantly higher body mass index, plasma brain natriuretic peptide (BNP) level, prevalence of hypertension, and larger left atrial size. Among patients with an AHI ≥10, the incidence of obstructive-dominant SA was 60.9% and that of central-dominant SA was 7.6%. The prevalence of hypertension was significantly higher in obstructive-dominant SA patients (obstructive vs. central: 48.3% vs. 20.0%, P = 0.038). The obstructive apnea index correlated with plasma BNP level and age, but the central and mixed apnea indices did not.
Conclusions: The prevalence of SA was common in AF ablation candidates, even without an obesity epidemic, and the SA type was predominantly obstructive. Portable polygraphy was useful for detecting undiagnosed SA patients in AF ablation candidates.

1. Introduction

Obstructive sleep apnea (OSA) is highly prevalent in atrial fibrillation (AF) patients, and is associated with the initiation and maintenance of AF [1,2]. Recently, central sleep apnea (CSA) was also reported to predict AF in older men [3]. Thus, sleep apnea (SA) is associated with the pathogenesis of AF, regardless of SA type. However, not only the exact prevalence of SA, but also the clinical determinants of SA and its type in AF patients are not well elucidated in the Asian population, where the prevalence of obesity is low compared to that in western countries. Therefore, we aimed to study the prevalence and the types of SA as well as their clinical characteristics in Japanese patients with AF, who were referred to our facility to undergo catheter ablation, through routine SA screening using portable polygraphy.

2. Methods

A total of 197 consecutive AF patients (age 60 ± 9 years, paroxysmal AF 111, male 187, $CHADS_2$ score 0.7 ± 0.9, CHA_2DS_2-VASc score 1.2 ± 1.1) who were scheduled to undergo catheter ablation were evaluated. Patients who were previously diagnosed with SA and treated with continuous positive airway pressure were excluded. Before catheter ablation, overnight sleep studies were performed using a type 3 portable monitor (Morpheus®, Teijin Pharma, Tokyo, Japan), that monitored chest and abdominal respiratory effort, nasal airflow through a pressure transducer, and arterial oxyhemoglobin saturation through pulse oximetry. The accuracy of this type of portable monitor in diagnosing SA and measuring its severity with high reproducibility compared with polysomnography (PSG) was previously validated [4–6]. Furthermore, the Epworth sleepiness scale (ESS) score was also calculated [7]. Echocardiography and plasma brain natriuretic peptide (BNP) measurements were also performed. Apnea and hypopnea were scored according to the American Academy of Sleep Medicine Manual [8]. We conducted two types of analysis. 1) We compared the clinical profiles according to the severity of SA, and patients with SA, who had an apnea–hypopnea index (AHI) ≥10 were compared with patients who had an AHI <10. 2) We also compared them according to the type of SA; and patients in the

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https://doi.org/10.1016/j.ijcard.2018.01.103
0167-5273/

Table 1
Comparison of the severity of sleep apnea.

	AHI <10 n = 62	AHI ≥10 n = 135	P value	OR	95% CI
$CHADS_2$	0.6 ± 0.9 (62)	0.7 ± 0.9 (135)	0.175	N/A	N/A
CHA_2DS_2-VASc	1.0 ± 1.1 (62)	1.2 ± 1.1 (135)	0.230	N/A	N/A
BMI	23.7 ± 2.4 (62)	25.5 ± 3.0 (135)	<0.001*	N/A	N/A
Age	59.0 ± 10.3 (62)	60.5 ± 8.4 (135)	0.411	N/A	N/A
BNP (pg/ml)	71.1 ± 67.1 (56)	102.5 ± 84.9 (116)	0.011*	N/A	N/A
LVEF (%)	58.3 ± 8.1 (53)	55.6 ± 11.0 (121)	0.212	N/A	N/A
LA (cm)	3.8 ± 0.6 (53)	4.1 ± 0.6 (121)	0.011*	N/A	N/A
AF duration (M)	44.2 ± 47.0 (22)	35.3 ± 36.8 (52)	0.523	N/A	N/A
ESS	4.1 ± 2.7 (50)	5.2 ± 3.1 (87)	0.048	N/A	N/A
Heart failure	3 (4.8%)	9 (6.6%)	0.444	1.405	0.367–5.379
Hypertension	15 (24.1%)	61 (45.2%)	0.005	2.583	1.318–5.062
Age > 65	22 (35.4%)	55 (40.7%)	0.483	1.250	0.670–2.331
Age > 75	3 (4.8%)	1 (0.7%)	0.093	0.147	0.015–1.440
Diabetes	10 (16.1%)	18 (13.3%)	0.602	0.800	0.346–1.852
Stroke	3 (4.8%)	5 (3.7%)	0.708	0.756	0.175–3.270
Female	4 (6.5%)	6 (4.4%)	0.389	0.674	0.183–2.481
Vascular disease	1 (1.6%)	3 (2.2%)	0.626	1.386	0.141–13.601
Persistent AF	23 (37.0%)	63 (46.6%)	0.208	1.484	0.801–2.748

The values are expressed as mean ± standard deviation (n) or n (%).
AF: atrial fibrillation, AHI: apnea-hypopnea index, BMI: body mass index, BNP: brain natriuretic peptide, ESS: Epworth sleepiness scale, LA: left atrial size measured using transthoracic echocardiography, LVEF: left ventricular ejection fraction, OR: odds ratio, 95% CI: 95% confidence interval.
* P value < 0.05

obstructive-dominant SA group were compared with those in the central-dominant SA group. Obstructive dominant SA was diagnosed when AHI was ≥10, in which obstructive and mixed apnea events comprised >50% of total apnea events. Central dominant SA was diagnosed when AHI was ≥10, in which central apnea events comprised >50% of total apnea events. SPSS statistical software (version 24.0, SPSS Inc., Chicago. IL, USA) was used to perform a Pearson's correlation, Mann–Whitney *U* test, and chi-square test. The odds ratio and 95% confidence interval were calculated. P-value of <0.05 was considered significant.

3. Results

Overall, the mean AHI was 17.7 ± 11.9 in AF ablation candidates, and the mean body mass index was 25.0 ± 3.0. The prevalence of hypertension and congestive heart failure was 38.6% (n = 76) and 6.1% (n = 12), respectively. One hundred thirty-five patients (68.5%) had an AHI ≥ 10, 106 (53.8%) had an AHI ≥ 15, and 31 patients (15.7%) had an AHI ≥ 30. A Comparison between the patients with an AHI ≥ 10 and those with AHI < 10 is shown in Table 1. Patients with an AHI ≥ 10 showed a significantly higher body mass index, plasma BNP level, and prevalence of hypertension and larger left atrial size.

Next, we compared the clinical characteristics of patients with obstructive-dominant SA (n = 120) and those with central-dominant SA (n = 15) among the patients with an AHI ≥10 (Table 2). In obstructive-dominant SA patients, the prevalence of hypertension was significantly higher compared to the prevalence in central-dominant SA patients. The $CHADS_2$ score and CHA_2DS_2-VASc score were higher in obstructive-dominant SA patients, although these differences were not statistically significant. The prevalence of hypertension was significantly higher in obstructive-dominant SA patients. The body mass index, plasma BNP level, left atrial size, or the AF type did not differ between the groups. The obstructive apnea index significantly correlated with the plasma BNP level (r = 0.320, P < 0.001) and age (r = 0.157, P = 0.027); however, the mixed or central apnea indices were not.

Table 2
Comparison between the types of sleep apnea (AHI > 10).

	Central dominant n = 15	Obstructive dominant n = 120	P value	OR	95% CI
$CHADS_2$	0.4 ± 0.6 (15)	0.8 ± 0.9 (120)	0.089	N/A	N/A
CHA_2DS_2-VASc	0.7 ± 1.0 (15)	1.3 ± 1.1 (120)	0.052	N/A	N/A
BMI	25.0 ± 1.8 (15)	25.6 ± 3.1 (120)	0.785	N/A	N/A
Age	58.6 ± 7.8 (15)	60.7 ± 8.5 (120)	0.325	N/A	N/A
BNP (pg/ml)	91.6 ± 68.2 (11)	103.6 ± 86.7 (105)	0.929	N/A	N/A
LVEF (%)	54.3 ± 13 (14)	55.8 ± 10.8 (107)	0.824	N/A	N/A
LA (cm)	4.1 ± 0.6 (14)	4.1 ± 0.6 (107)	0.709	N/A	N/A
AF duration (M)	42.8 ± 52.9 (4)	34.7 ± 35.9 (48)	0.679	N/A	N/A
ESS	4.2 ± 3.2 (12)	5.3 ± 3.1 (75)	0.220	N/A	N/A
Heart failure	1 (6.7%)	8 (6.7%)	0.665	1.000	0.116–8.60
Hypertension	3 (20.0%)	58 (48.3%)	0.038*	3.742	1.005–13.936
Age > 65	4 (26.7%)	51 (42.5%)	0.239	2.033	0.612–6.75
Age > 75	0 (0%)	1 (0.8%)	0.889	N/A	N/A
Diabetes	0 (0%)	18 (15%)	0.103	N/A	N/A
Stroke	1 (6.7%)	4 (3.3%)	0.450	0.483	0.050–4.628
Female	0 (0%)	6 (5%)	0.486	N/A	N/A
Vascular disease	1 (6.7%)	2 (1.7%)	0.300	0.237	0.020–2.787
Persistent AF	5 (33.3%)	58 (48.3%)	0.272	1.871	0.603–5.801

The values are expressed as mean ± standard deviation (n) or n (%).
AF: atrial fibrillation, BMI: body mass index, BNP: brain natriuretic peptide, ESS: Epworth sleepiness scale, LA: left atrial size measured using transthoracic echocardiography, LVEF: left ventricular ejection fraction, OR: odds ratio, 95% CI: 95% confidence interval.
* P value < 0.05