

SCIENTIFIC LETTER

Arterial oxygen desaturation during sleep and atrial fibrillation

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Atrial fibrillation is a common arrhythmia with associated complications of stroke and other adverse outcomes. We conducted a population-based study of 1763 Japanese men aged 40–74 years to examine the association between the frequency of nocturnal oxygen desaturation, estimated by a pulse oximeter, and the prevalence of atrial fibrillation. We found a significant association between the severity of sleep-disordered breathing (SDB) and the prevalence of atrial fibrillation; the odds ratios (ORs) were 2.47 for those with 5–15 events/h of 3% oxygen desaturation index (ODI) level and 5.66 for those with ≥ 15 events/h of 3% ODI level (p for trend = 0.02).

Although the association of SDB with atrial fibrillation has been reported in recent clinical studies,^{1–4} no population-based epidemiological study has examined this relationship. We investigated the association between the frequency of nocturnal oxygen desaturation and the prevalence of atrial fibrillation among community-based subjects.

METHODS

The subjects were 1763 Japanese men aged 40–74 years who lived in three Japanese communities. They participated in the 2000–2004 annual cardiovascular risk surveys and were recruited for the present sleep study, at a total recruitment rate of 84%. The sensor of the pulse oximeter (PULSOX-3Si, Minolta, Japan) was attached to the index finger during all-night sleep at home.⁵ We used a sleep log to exclude waking time from the analysis to minimise potential overestimation of sleep duration. Data from people with total recording time < 4 h, or with artefacts likely due to frequent body movement, inadequate fitting of the probe or excessive pulse pressure ($n = 100$) were excluded, and data from 1663 men were used for the analyses.

A 3% ODI was used to define SDB: 5– < 15 events/h was considered mild SDB and ≥ 15 events/h was considered moderate to severe SDB.⁵ Standard 12-lead electrocardiograms were recorded in the supine position. Each record was coded independently using the Minnesota Code by two trained cardiovascular doctors. The criterion for atrial fibrillation was Minnesota Code 8-3.

To compare the mean values of selected cardiovascular characteristics, we used analysis of covariance with age as covariate. The logistic regression analysis was used to obtain the ORs of the prevalence of atrial fibrillation according to categories of 3% ODI levels (table 1) after adjustment for age, body mass index, alcohol intake, smoking status (never, former smoker, currently 1–19 cigarettes/day and currently ≥ 20 cigarettes/day), systolic blood pressure and the use of anti-hypertensive drugs. The study was approved by the medical ethics committee of the University of Tsukuba, Tsukuba, Japan, and written informed consent was obtained from all participants.

RESULTS

The mean age, body mass index, alcohol intake, blood pressure, prevalence of use of anti-hypertensive drugs and

Table 1 Age-adjusted means (SEM), prevalence of selected cardiovascular risk characteristics and multivariate-adjusted prevalence of atrial fibrillation in electrocardiogram according to 3% oxygen desaturation index (ODI) among 1663 men

	3% ODI			p for trend
	0–4	5–14	15+	
n	975	534	154	
Age, year	58.7 (0.3)	59.8 (0.4)	61.1 (0.7)	< 0.001
BMI, kg/m ²	23.1 (0.1)	25.0 (0.1)	26.7 (0.2)	< 0.001
Current ethanol intake, g/day	22.2 (0.8)	25.2 (1.0)	26.1 (1.9)	0.014
Current smokers, %	44	38	32	0.001
Systolic blood pressure, mm Hg	130.8 (0.5)	133.8 (0.7)	137.6 (1.3)	< 0.001
Diastolic blood pressure, mm Hg	80.7 (0.3)	82.9 (0.4)	84.9 (0.8)	< 0.001
Use of antihypertensive drugs, %	18	25	35	< 0.001
Hypertension,* %	42	51	62	< 0.001
Atrial fibrillation n	7	11	8	
Multivariate-adjusted prevalence†	0.8	1.9	4.9	< 0.001
Multivariate-adjusted OR (95% CI)†	1	2.47 (0.91, 6.69)	5.66 (1.75, 18.34)	0.020

BMI, body mass index; OR, odds ratio.

*Hypertension was defined as systolic blood pressure ≥ 140 mm Hg, diastolic blood pressure ≥ 90 mm Hg or use of antihypertensive drugs.
†Adjusted for age, BMI, alcohol intake, smoking status, systolic blood pressure and use of antihypertensive drugs.

hypertension correlated positively with the 3% ODI level. After adjustment for these covariates, the ORs for atrial fibrillation were 2.47 (95% confidence interval (CI), 0.91 to 6.69) for those with 5– < 15 of 3% ODI level (event/h) and 5.66 (95% CI 1.75 to 18.34) for those with ≥ 15 of 3% ODI level (p for trend = 0.02).

DISCUSSION

We found a significant positive association between the severity of SDB and the prevalence of atrial fibrillation among community-dwelling Japanese men, independent of cardiovascular risk factors. The exact mechanisms for the association between SDB and atrial fibrillation are not clear but include chronic intermittent hypoxaemia, hypercapnia, intrathoracic pressure swing and activation of sympathetic nervous function, resulting in cardiac electric instability, distortion of cardiac configuration and hypertension.^{1–4} SDB is treatable through weight reduction and continuous positive airway pressure.^{1,2} A recent clinical case report showed that the onset of atrial fibrillation was preceded by a long apnoeic event, and spontaneous reversal to sinus

Abbreviations: ODI, oxygen desaturation index; SDB, sleep-disordered breathing

rhythm occurred after a period without apnoeas.³ On the other hand, atrial fibrillation usually reduces cardiac output and the reduced cardiac output may lead to central apnoea during sleep, mainly owing to the chemoreflex enhancement and prolonged lag to ventilatory response.⁵ We should further clarify whether subjects with atrial fibrillation have a central apnoea pattern by polysomnography.

Atrial fibrillation is a common arrhythmia with associated complications of stroke and other adverse outcomes. Furthermore, atrial fibrillation is an extremely costly public health problem; the direct cost of atrial fibrillation was estimated as 459 million in the year 2000, equivalent to 0.97% of the total National Health Service expenditure.⁶ This study suggests that the detection of SDB and its successful treatment could be one of the public health approaches to reduce the risk and the cost of atrial fibrillation.

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TT, TS and HI designed the study. TT, KY, SS, HN and IM collected and analysed the data. IM and TT carried out statistical analysis of the data. HI, TT and TS coordinated the study. The manuscript was prepared mainly by TT and HI, with contributions from SS, KY and TS.

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IMAGES IN CARDIOLOGY

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Unusual diagnosis of ascending aorta dissection with left ventricular angiogram



Left ventricular angiogram after ejection of the contrast product. Note the intimal flap in the ascending aorta between the true and the false lumen. See video 1 to observe retrograde opacification of the false lumen.

A 49-year-old patient with no medical history was referred to the cardiology department for an acute coronary syndrome. The patient presented with an acute, oppressive chest pain associated with nausea. Physical examination showed symmetric arm blood pressure, all peripheral pulses were present, and there was no evidence of cardiac murmur or abdominal signs. The ECG showed an ST segment elevation on the anterior leads. A coronary angiogram was performed showing normal coronary arteries. The left ventricular angiogram showed an acute dissection of the ascending aorta (see panel and video 1; to view video footage visit the *Heart* website—<http://www.heartjnl.com/supplemental>). The delayed retrograde opacification of the false lumen toward the aortic root suggested a site of origin close to the aortic arch. The patient was prepared for emergency cardiac surgery. In the operating room, the patient's pressure collapsed while transoesophageal echocardiography showed a total obliteration of the ascending aorta by the false lumen (videos 2 and 3) resulting in cardiac arrest. Extracorporeal circulation was quickly instituted between the right femoral artery and the right atrium. Surgical treatment consisted of the resuspension of the native aortic valve and sus coronary replacement of the ascending aorta (26 mm Dacron tubular graft). The intimal tear was localised close to the origin of the innominate artery and removed with the ascending aorta. The patient recovered with an uneventful postoperative course. A wide range of clinical manifestations characterise aortic dissection. The diagnosis of ascending aorta dissection should be evocated even in the case of typical acute coronary syndrome.

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