

Ethnicity, Obstructive Sleep Apnoea and Ischaemic Heart Disease

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Abstract

We studied the relationship between different ethnic groups, obstructive sleep apnoea (OSA) and ischaemic heart disease. Four hundred and thirty-two inpatients from the medical wards were interviewed. Limited overnight sleep studies were done in 129 of those who had habitual snoring, daytime sleepiness based on an Epworth sleepiness scale of 8 or more, or a large neck size of 40 cm or more.

There were 315 Chinese (72.9%), 67 Malays (15.5%), 43 Indians (10%) and 3 from other races (1.4%). The prevalence of OSA was 19.7%, 30% and 12% among the Chinese, Malays and Indians, respectively. The prevalence ratio for OSA was 1.52 in Malays using Chinese patients as the baseline ($P = 0.07$). The median neck circumference was 37 cm in both racial groups. The median body mass index was 22.7 kg/m² in Chinese compared to 23.6 kg/m² in Malays. The median apnoea-hypopnoea index was 22.7, 19.0 and 26.9 events/hour among the Chinese, Malays and Indians, respectively.

OSA was independently associated with the prevalence of IHD (adjusted prevalence ratio 1.68; 95% CI: 1.15, 2.46; $P = 0.009$). The prevalence of ischaemic heart disease (IHD) was 31%, 24% and 28% in Chinese, Malays and Indians, respectively. The prevalence ratio for IHD in Malays compared to Chinese was 0.77. After adjusting for OSA, there was an even greater reduction in the risk of IHD (adjusted prevalence ratio 0.70). This suggests that OSA is a confounder in the relationship between race and ischaemic heart disease.

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Introduction

Obstructive sleep apnoea (OSA) is a condition whereby there is snoring associated with complete or partial cessation of breathing during sleep, associated with nocturnal oxygen desaturation and sleep fragmentation.¹ This condition can lead to the effects of sleep fragmentation such as motor vehicular accidents, accidents in the workplace, social disharmony and marital discord.¹ In the long-term, it can also lead to ischaemic heart disease (IHD) and stroke.^{2,3}

In most studies, the prevalence of OSA in the general population is in the region of 2% in women and 4% in men.* Our aims were:

- 1) to study the prevalence of this condition in different racial groups as there is no information to date re-

- garding ethnicity and OSA.¹, and
- 2) to study if this condition has an important influence on the risk of IHD among the different races.

Materials and Methods

Between 1 October 1996 and 31 January 1997, 432 patients admitted to the various medical departments of our 1600-bedded tertiary hospital were invited to participate in this study. Their ages ranged from 30 to 75 years. They did not have advanced malignancy, end-stage renal failure, human immunodeficiency virus (HIV) infection or impaired mental function. This study had the approval of our hospital's ethics committee. The interviewers administered a standard questionnaire twice a week to all the patients satisfying the entry

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criteria in each ward. Snoring was considered habitual if it occurred 5 days or more within a week. At the time of the interview, we also recorded the neck circumference at the level of the cricothyroid membrane, height, weight and body mass index (BMI) of the patients. The patient was considered to have IHD if there was a positive history of angina, and/or electrocardiogram changes, and/or findings on coronary angiogram based on the case-records.

A limited sleep study (Sullivan Autoset, Rescare Limited) was carried out in patients when there was a history of habitual snoring, excessive daytime sleepiness [Epworth sleepiness scale⁴ (ESS) ≥ 8] or a neck circumference (NC) of 40 cm or more. This is a computer-controlled nasal CPAP flow generator where the diagnostic mode is selected and the only sensors required are an oximeter and standard nasal prongs. An apnoea episode corresponds to cessation of nasal air-flow for ≥ 10 s and a hypopnoea episode corresponds to greater than 50% reduction in flow for ≥ 10 s. The apnoea-hypopnoea index (AHI) is the number of apnoeas and hypopnoeas per hour.

Modified Cox's models assuming "constant follow-up time" were used to model relationships between race, OSA and IHD and to adjust for confounding covariates. This method (despite its disadvantage of assuming Poisson error for prevalence, which is a binomial variate) was used in preference to logistic regression so that results in the form of prevalence ratios could be obtained. Model comparison was performed using the likelihood ratio test.

Results

There were 315 Chinese (72.9%), 67 Malays (15.5%) 43 Indians (10%) and 7 from other races (1.6%). Their ages ranged from 30 to 75 years, with a median age of 60 years (interquartile range of 46 to 68 years). There were 179 female and 253 male subjects with a sex ratio of males to females of 58.6:41.4. The median body mass index in our study population was 23.1 kg/m² (interquartile range of 20.3 to 26.9 kg/m²).

The prevalence of OSA was 19.7%, 30% and 12% amongst Chinese, Malays and Indians respectively (Table I). The prevalence ratio for OSA was 1.52 and 0.59 in Malays and Indians respectively when using Chinese patients as the baseline, showing that Malays had the highest prevalence of OSA compared to other ethnic groups ($P = 0.07$). The age-adjusted prevalence ratio was 1.70 in Malays versus Chinese. The median neck circumference was 37 cm in both the Chinese and Malays. The median body mass index was 22.7 kg/m² in Chinese compared to 23.6 kg/m² in Malays ($P = 0.39$).

Amongst those with OSA, the median AHI was 22.7, 19.0 and 26.9 events per hour in Chinese, Malays and Indians respectively ($P = 0.85$). The majority of the

subjects had mild to moderate OSA. Only about 10% to 15% in each ethnic group had severe OSA (Table II).

There was a significant association between OSA and the prevalence of IHD (Table III) which persisted even after the inclusion of known risk factors for IHD in the model. The adjusted prevalence ratio for IHD in patients with OSA compared with patients without OSA was 1.68 (95% CI: 1.15, 2.46; $P = 0.009$).

The prevalence of IHD was 31%, 24% and 28% in

TABLE I: ETHNICITY AND PREVALENCE OF OBSTRUCTIVE SLEEP APNOEA

Race	Prevalence	%	95% CI	Prevalence ratio	95% CI	<i>P</i> value
Chinese	62/315	19.7	15.7-24.4	Baseline		
Malay	20/67	30	20-42	1.52	0.99-2.33	0.07
Indian	5/43	12	5-25	0.59		

CI: confidence interval

TABLE II: ETHNICITY AND SEVERITY OF OBSTRUCTIVE SLEEP APNOEA

	Mild OSA AHI 10-29	Moderate OSA AHI 30-49	Severe OSA AHI 50	Total OSA
Chinese	29 (47%)	27 (43%)	6 (10%)	62
Malay	13 (65%)	4 (20%)	3 (15%)	20
Indian	2 (40%)	3 (60%)	0 (0%)	5

OSA: obstructive sleep apnoea

AHI: apnoea-hypopnoea index

TABLE III: ASSOCIATION OF OSA WITH IHD PREVALENCE

Association with IHD	Prevalence ratio	Confidence interval	* <i>P</i> value
OSA versus Non-OSA Unadjusted	2.26	1.58, 3.23	<0.0001
OSA versus Non-OSA (adjusted for age, sex, hpt, DM, BMI, smoking)	1.68	1.15, 2.46	0.009

IHD: ischaemic heart disease; OSA: obstructive sleep apnoea;

hpt: hypertension; DM: diabetes mellitus; BMI: body mass index

* *P* values obtained comparing relevant modified Cox's models with and without OSA using the likelihood ratio test

TABLE IV: ETHNICITY AND PREVALENCE OF ISCHAEMIC HEART DISEASE

	IHD prevalence	
	Number	%
Chinese	98/315	31
Malay	16/67	24
Indian	12/43	28

IHD: ischaemic heart disease

TABLE V: ADJUSTED PREVALENCE RATIOS FOR ISCHAEMIC HEART DISEASE IN MALAYS VERSUS CHINESE*

Association with IHD	Prevalence ratio	Confidence interval	Prevalence ratio with additional adjustment for OSA	Confidence interval
Malay versus Chinese (unadjusted)	0.77	0.46, 1.31	0.70	0.41, 1.19
Malay versus Chinese (adjusted for age and sex)	0.89	0.52, 1.52	0.81	0.48, 1.39
Malay versus Chinese (adjusted for age, sex, hpt, DM, BMI, smoking)	0.89	0.50, 1.57	0.83	0.47, 1.46

IHD: ischaemic heart disease; OSA: obstructive sleep apnoea; hpt: hypertension; DM: diabetes mellitus; BMI: body mass index

* Adjustment performed using modified Cox's model with assumed "constant follow-up"

Chinese, Malays and Indians, respectively (Table IV). Table V shows that the prevalence ratio for IHD in Malays compared to Chinese was 0.77 and after adjusting for OSA, there was an even greater reduction in the risk of IHD (adjusted prevalence ratio 0.70).

Discussion

The Sullivan AutoSet has a good correlation ($r = 0.85$) between the number of apnoea-hypopnoeas per hour recorded in bed compared to polysomnography. In one study by Bradley et al⁵ (threshold AH1 215 events/hour), AutoSet has a sensitivity of 100%, specificity of 92%, positive predictive value of 92% and negative predictive value of 100%. In another study by Gugger et al⁶ (threshold AH1 ≥ 20 events/hour), it gave a sensitivity of 82% and a specificity of 90%.

The ethnicity of our study population conforms well to that of the Singapore population, which has been estimated by the Department of Statistics, Singapore as 77.4% Chinese, 14.2% Malays and 7.2% Indians (1995). Our study showed that the prevalence of OSA was highest in the Malays although this was not statistically significant. This was probably because our sample size was not large enough. Future studies such as cephalometry and genetic studies may be helpful to determine why this should be so as there were no significant differences in the neck size and body mass index in the Chinese and Malays to explain why Malays should have a higher prevalence of OSA.

The prevalence of IHD was high in our series. Besides being dependent on the inclusion and exclusion criteria, it also reflected the pattern of medical admissions in our tertiary setting.

We also observed in our series of inpatients that Malays were less likely to suffer from IHD compared to Chinese. As the population of Indians, especially those with IHD

was small, it was difficult for us to compare the prevalence of this condition with other ethnic groups. In most studies, the prevalence of IHD is highest in the Indians.^{7,8} Our study showed that Chinese had the highest prevalence of this condition. Chinese with IHD may be over-represented in our study and this may reflect the pattern of seeking medical care in the different races.

OSA was associated with the prevalence of IHD independent of sex, age, hypertension, diabetes mellitus, BMI and smoking. As this is a cross-sectional study, we would be cautious about inferring causal relationships. Nevertheless, OSA is a potentially important confounding factor in the relationship between race and IHD as reflected by the decrease in odds ratio after adjusting for it.

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