

Atrial natriuretic peptide levels in the sleep apnoea/hypopnoea syndrome

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Abstract

Background - Patients with the sleep apnoea/hypopnoea syndrome have increased salt and water excretion at night which has been reported to be associated with an increase in plasma levels of atrial natriuretic peptide (ANP). A study was performed to determine whether any rise in plasma ANP levels was related to nocturnal hypoxaemia.

Methods - Nine patients with sleep apnoea/hypopnoea syndrome were studied on two nights, one breathing air and the other 28% oxygen, the order being randomised. Venous levels of ANP, aldosterone, and renin activity were measured.

Results - No decrease in plasma ANP levels on oxygen was seen, and, indeed, there was no evidence of an overnight increase in ANP levels.

Conclusion - Oxygen therapy does not diminish nocturnal plasma ANP levels in patients with sleep apnoea/hypopnoea syndrome.

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Nocturia is common in the sleep apnoea/hypopnoea syndrome,¹⁻³ is associated with increased nocturnal salt and water excretion, and is reversed by continuous positive airway pressure (CPAP) therapy.^{2,4} The nocturia has been associated with increased plasma levels of atrial natriuretic peptide (ANP)^{5,6} which are corrected with CPAP.⁵ Causes suggested for the rise in ANP include intrathoracic pressure swings, haemodynamic sequelae of arousal, or

pulmonary hypertension related to hypoxaemic episodes. We have investigated this last hypothesis as plasma levels of ANP in other situations relate to hypoxaemia.^{7,8}

Methods

Nine men of mean (SE) age 52 (5) years with the sleep apnoea/hypopnoea syndrome (median 52 (range 23-115) apnoeas + hypopnoeas/hour) spent two consecutive nights undergoing our standard polysomnographic recordings,⁹ arousals being defined as a 1.5 second return of alpha or theta rhythm with an increase in EMG, however brief.¹⁰ On both nights they breathed through a mask, on one night receiving air and the other 28% oxygen. An arterial sample was drawn 30 minutes after the mask was fitted. An indwelling venous catheter was sited and the subjects lay for 30 minutes before baseline samples were drawn. Four further samples were taken during non-REM sleep at 30 minute intervals and up to three during REM sleep at 10 minute intervals. Levels of ANP¹¹ and plasma renin activity^{11,12} were assayed by standard techniques and plasma aldosterone levels by radioimmunoassay (Euro Diagnostic Products Ltd, Llanberis, UK). Urine levels of dopamine were measured by high performance liquid chromatography following standard extraction.¹³ Statistical analysis was by the Student's *t* test.

Results

Oxygen therapy improved the presleep arterial oxygen tension (16 (1) kPa on oxygen, 10 (1) kPa on air; $p=0.001$) without changing arterial P_{CO_2} and also raised the lowest nocturnal oxygen saturation (median 81% (range 13-95%) on oxygen; 55% (0-87%) on air; $p<0.02$). There was no difference in the number or duration of apnoeas or hypopnoeas on the two nights, but there was a slight increase in the frequency of arousal from non-REM sleep during the night on air (table 1).

There were no significant differences in presleep levels of ANP, aldosterone, or plasma renin activity between the two nights, nor any differences in the average levels obtained during sleep. There was, however, a weakly significant increase ($p<0.05$) in ANP levels when oxygen

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Table 1 Comparison of sleep and breathing during nights on air and oxygen

	Night on air	Night on supplemental oxygen	<i>p</i>
Non-REM sleep:			
Apnoeas + hypopnoeas (A + H)/hour	72 (14)	59 (15)	>0.2
Mean duration of A + H (seconds)	21 (3)	22 (2)	>0.5
Arousals/hour	89 (13)	71 (10)	0.02
REM sleep			
Apnoeas + hypopnoeas (A + H)/hour	61 (13)	33 (12)	>0.1
Mean duration of A + H (seconds)	27 (7)	32 (12)	>0.5
Arousals/hour	44 (9)	45 (11)	>0.9
Total sleep time (min)	226 (25)	171 (22)	>0.05
Non-REM sleep	192 (21)	157 (20)	>0.2
REM sleep	34 (10)	14 (5)	0.01

Values are mean (SE)

Table 2 Comparison of venous blood levels of ANP, aldosterone and plasma renin activity (PRA) and urinary dopamine levels during nights on air and oxygen

	Night on air	Night on supplemental oxygen	p
ANP (pg/ml)			
Pre-sleep	81 (29)	88 (30)	>0.9
Non-REM sleep	75 (10)	95 (11)	<0.05
REM sleep	95 (12)	78 (15)	>0.6
Aldosterone (pg/ml)			
Pre-sleep	326 (127)	328 (137)	>0.9
Non-REM sleep	225 (39)	217 (44)	>0.9
REM sleep	235 (39)	265 (97)	>0.6
PRA (ng AngI/ml/h)			
Pre-sleep	4.0 (1.2)	3.6 (1.2)	>0.2
Non-REM sleep	2.6 (0.3)	2.7 (0.5)	>0.2
REM sleep	1.8 (0.4)	1.9 (0.4)	>0.8
Urinary dopamine (nmol/2300-0400 hours)	656 (146)	633 (66)	>0.8

Laboratory normal ranges: ANP, 10–110 pg/ml; aldosterone, 10–160 pg/ml; PRA, 0.1–3.1 ng AngI/ml/h (supine); urinary dopamine, 650–2280 nmol/24 hours.

was given compared with the night on air. There was no difference in urinary dopamine levels between the two nights (table 2).

Discussion

This study shows no diminution in plasma ANP levels with oxygen therapy. Indeed, post hoc analysis showed no significant increase in ANP levels during sleep. This latter observation is compatible with a report by Partinen *et al*⁸ in a group of 17 snorers, nine with sleep apnoea/hypopnoea syndrome. The decreases in ANP levels with CPAP reported in some,^{5,14} but not all,^{15,16} studies may be due to either normalisation of intrathoracic pressure or improvements in sleep quality.

The marginal elevation in plasma levels of ANP in non-REM sleep during the night on oxygen is of dubious significance, may reflect the number of comparisons made, and cannot be readily explained by changes in breathing or sleep pattern.

The high baseline aldosterone levels and plasma renin activity were due to three patients

receiving diuretics. However, these patients were acting as their own controls for the a priori comparison of air against oxygen which is not invalidated by this therapy.

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