Author’s Reply
Home Oxygen Therapy and Sleep Quality of Heart Failure Patients

My colleagues and I reported the efficacy of nocturnal home oxygen therapy (HOT) in improving sleep disordered breathing, left ventricular function and quality of life in patients with congestive heart failure (CHF) and central sleep apnea with Cheyne-Stokes respiration (CSR-CSA), suggesting its potential usefulness as an additional option for non-pharmacological therapy of CHF! However, in that study, polysomnography (PSG) was not available in all cases and a cardiorespiratory monitoring device was used instead. Recently, the number of specialized sleep laboratories has increased considerably in Japan, but this study was conducted between January 2001 and June 2002 when sleep study was not very popular, particularly in cardiology departments. Even today, the total number of PSG performed to diagnose sleep apnea and to initiate therapy is still limited. At July 2005, it was estimated that 560 sleep centers were present in Japan, but only 48 of them were accredited by the Japanese Society of Sleep Research? Thus, the majority of centers still remain non-accredited. This presents quite a contrast to the fact that American Academy of Sleep Medicine had already accredited 507 centers in the United States in 2001! Among 20 centers that participated in the CHF-HOT study, only 3 centers were included in Japanese Society of Sleep Research accredited sleep laboratories. Therefore, we could not provide mean group data of the PSG studies, however, the limited data clearly indicate that nocturnal oxygen improved sleep in terms of fewer arousals, and stage 1 sleep and more stage 2 and slow-wave sleep. With regard to the feeling at awaking and daytime sleepiness, we asked all the patients to answer a 4-point questionnaire at baseline and at the end of the study. Distributions of the impression of improvement in the 2 items were significantly different between the HOT and control groups (Table 1).

Repetitive oxygen desaturation and arousals cause an increase in sympathetic activity. Actually, patients with CSR-CSA and CHF have significantly greater cardiac norepinephrine (NE) spillover compared with CHF patients without apnea or those with obstructive sleep apnea! In our study, we could not demonstrate changes in plasma NE levels by spot serum sampling in the morning. However, urinary catecholamine levels are reported to be a more representative indicator of overall nocturnal sympathetic activity and oxygen therapy can decrease overnight urinary catecholamine excretion? Oxygen therapy may also reduce sympathetic activity measured by peroneal microneurography during voluntary central apnea in patients with CHF!. Since enhanced sympathetic activity plays a major role in the progression and outcome of CHF and oxygen decreases this activity, long-term therapy with HOT appears to have potential to improve morbidity and mortality in patients with CSR-CSA and CHF. It was as early as 1908 when Pembrey first demonstrated the efficacy of nasal oxygen in the treatment of patients with CSR-CSA and CHF. Though nearly 100 years have passed, it has not been elucidated conclusively whether treatment of CSA with oxygen improves the prognosis of patients with CHF! We have already started an outcome trial to test this hypothesis. Enrolment of patients was finished in May 2005 and we hope to provide a definitive conclusion before long.

References

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Table 1 Changes in Sleep Quality in the HOT and Control Groups

<table>
<thead>
<tr>
<th>Item</th>
<th>n</th>
<th>Improved</th>
<th>Unchanged</th>
<th>Worsening</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeling at awakening</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOT</td>
<td>25</td>
<td>15 (60.0%)</td>
<td>8 (32.0%)</td>
<td>2 (8.0%)</td>
<td>0.002</td>
</tr>
<tr>
<td>Control</td>
<td>31</td>
<td>6 (19.4%)</td>
<td>16 (51.6%)</td>
<td>9 (29.0%)</td>
<td></td>
</tr>
<tr>
<td>Daytime sleepiness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOT</td>
<td>25</td>
<td>8 (32.0%)</td>
<td>13 (52.0%)</td>
<td>4 (16.0%)</td>
<td>0.039</td>
</tr>
<tr>
<td>Control</td>
<td>31</td>
<td>2 (6.5%)</td>
<td>21 (67.7%)</td>
<td>8 (25.8%)</td>
<td></td>
</tr>
</tbody>
</table>

Values and those in the parentheses are expressed as number of patients and proportion of patients, respectively. HOT, home oxygen therapy. P value was calculated by Mann-Whitney U test.