COPD and OSA: Is there a link?

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Chronic obstructive pulmonary disease (COPD) is characterized by progressive persistent airflow limitation that is usually associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases.
DEFINITION

Adult SDB is present when repetitive apneas (episodes of breathing cessation) and hypopneas (episodes of decrement in airflow) occur during sleep, usually associated with sleep fragmentation, arousals, and reductions in oxygen saturation. Apneas defined as an episode of breathing cessation lasting at least 10 seconds in duration, SDB events during which decrements in airflow are observed.
Apnea-hypopnea index

AHI has been used to evaluate severity of obstructive sleep apnea (OSA) and treatment outcome

- AHI = Apnea + Hypopnea

Hours of sleep

- mild (5–15 events/hour)
- moderate (15–30 events/hr)
- severe (> 30 events/hr)

Overlap Syndrome

Rahman shawon, et al →
21 observational studies
n = 29,341 participant

3.60% general and hospital population
55.70% OSA
65.90% COPD

Overlap syndrome
Overlap syndrome prevalence in COPD populations vary depending on population in dose-dependent response.

Overlap syndrome

- 0.50% in mild COPD
- 39% in moderate to severe COPD
- 65% in severe COPD
Overlap syndrome prevalence in COPD populations vary depending on population in dose-dependent response

Consideration:

1. COPD-OSA prevalent influenced by age

2. Severity in COPD affect AHI

Krachman et al → emphysema and increase gas trapping associated with decrease AHI
Overlap syndrome patient had higher ODI in comparison to OSA non-COPD patient.

COPD patient with borderline hypoxemia will desaturate more quickly for a small degree of upper airway obstruction.
COPD patient is on a steep of oxygen dissociation curve
The association between COPD and OSA is not fully understood. Whether COPD and OSA coexistence were mere fortuituously or an actual interaction is an open question.
Major domains of sleep-disorder breathing in COPD Patients

- Sleep related hypoxemia
- Coexisting obstructive sleep apnea
- Hypoventilation during sleep
- Respiratory effort related arousals
Sleep condition in COPD patients

Akinci, et al → 94% of moderate to severe COPD subjects had poor sleep quality

- Genioglossal activity ↓
- Airway collapsibility ↓
- Poor sleep quality
- Accessory muscle contraction ↓ ↓ → FRC ↓
- Respiratory drive ↓ ↓
- REM ↓
- OSA
- COPD

AMPLIFIED ALTERATION SLEEP ADAPTION
Relationship of COPD to OSA

Risk factor for OSA

Chronic mucosal inflammation
Tonsilar and adenoid hypertrophy
(+ active smoking)

Upper airway edema and higher upstream \( \uparrow \)

Airway collapsibility in COPD patient

Impaired muscle
Central fat deposition

Rostral fluid shift
COPD have a mixture of emphysema and chronic bronchitis, and thus the probability of OSA will likely represent the balance of these protective and promoting factors in individual COPD patients.

Protect against OSA:
- Low BMI
- Diminished REM
- Medication: theophylline
OSA \( \rightarrow \) COPD

OSA exacerbate lower airway inflammation in patient with COPD

COPD Exacerbation (event/24month)

- Mild COPD: 1 event
- Moderate to severe COPD: 2 events

P = 0.009
Overlap syndrome were more likely to suffer a severe COPD exacerbation leading to hospitalization.

Severe COPD exacerbation leading to hospitalization (relative risk, 1.70; 95% confidence interval, 1.21-2.38) versus the COPD-only group.

COPD Hospitalization due to exacerbation:

- COPD only: 39.50%
- COPD Overlap Syndrome: 61.40%
- Treated with CPAP: 46.90%

OSA exacerbate lower airway inflammation in patients with COPD

<table>
<thead>
<tr>
<th></th>
<th>BAL Mononuclear (%)</th>
<th>BAL Neutrophils (%)</th>
<th>BAL TNFα</th>
<th>BAL IL-8 (pg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COPD</strong></td>
<td>80.8</td>
<td>16.5</td>
<td>40</td>
<td>57.9</td>
</tr>
<tr>
<td><strong>Overlap Syndrome</strong></td>
<td>71.8</td>
<td>25.7</td>
<td>60</td>
<td>88.1</td>
</tr>
<tr>
<td><strong>P-values</strong></td>
<td>P=0.002</td>
<td>P&lt;0.001</td>
<td>P&lt;0.001</td>
<td>P&lt;0.001</td>
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</tbody>
</table>

Chronic intermittent hypoxia → Free oxygen radical release → CD68+ macrophage → Elastase in lungs → Lung damage
Overall risk of death was significantly higher in patients OSA/COPD overlap syndrome.
COPD-OSA overlap syndrome patients treated with CPAP have lower mortality compared with COPD-OSA overlap syndrome without CPAP.
Longer CPAP use was associated with reduced mortality in COPD-OSA overlap syndrome patients.
FEV1/FVC were significantly lower in overlap syndrome than OSA only (70.80±8.67 vs 83.15±5.15; p =0.001)
Hypercapnia with relatively preserved lung function should prompt an evaluation for OSA

<table>
<thead>
<tr>
<th>Table 3  Anthropometric, Respiratory Function, and Polysomnographic Characteristics of COPD and Overlap Groups (mean ± SD)</th>
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</thead>
<tbody>
<tr>
<td><strong>Overlap Group (n = 29)</strong></td>
</tr>
<tr>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>Weight (Kg)</td>
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<tr>
<td>BMI (Kg/m2)</td>
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<tr>
<td>FVC% of predicted</td>
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<tr>
<td>FEV1% of predicted</td>
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<tr>
<td>FEV1/FVC%</td>
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<tr>
<td>$\text{PaO}_2$ (mm Hg)</td>
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<tr>
<td>$\text{PaCO}_2$ (mm Hg)</td>
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<tr>
<td>AH1/h</td>
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<tr>
<td>TST $\text{SaO}_2&lt;90%$</td>
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</tbody>
</table>

ANOVA, analysis of variance; BMI (Kg/m²), body mass index; FVC, forced volume capacity; FEV1, forced expiratory volume in 1 second; AH1/h, apnea-hypopnea index (nr/h); TST $\text{SaO}_2<90\%$, % of total sleep time with $\text{SaO}_2<90\%$. 

CONCLUSION

- Sleep apnea is a common comorbidity of COPD and affected each other.
- OSA-COPD overlap syndrome had prolonged hypoxia and night-time hypercapnia.
- Both diseases cause systemic impacts which are inflammation and oxidative stress.
- COPD-OSA overlap syndrome had higher mortality in comparison to OSA or COPD alone.
- Hypercapnia with less severe lower airway obstruction warrant an OSA screening.
Thank you!