Review article

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SLEEP AND BREATHING IN IDIOPATHIC PULMONARY FIBROSIS

The outcome of patients with idiopathic pulmonary fibrosis (IPF), which represents the most common type of idiopathic pulmonary pneumonias, is poor. Breathlessness and coughing are usually progressive and about 50% of the patients die within 3 years after diagnosis. The effect of medical treatment in terms of survival is disappointing. Most of the currently available studies only focus on daytime diagnostics and therapy. The role of sleep quality and sleep disordered breathing in IPF is only investigated in a small number of papers, which can be summarized as follows: sleep fragmentation in IPF is very common. The reasons might be coughing, nocturnal oxygen desaturations, and increased respiratory drive. Sleep disorders in IPF have a profound impact on the quality of life. Oxygen desaturations often appear during sleep and can be predicted by the PaO2 during wakefulness. There are no evidence-based recommendations concerning the indication for oxygen therapy and non-invasive ventilation during sleep in IPF. Obstructive sleep apnea (OSA) has no increased incidence with the exception of the IPF patients with an increased body mass index. If, however, OSA is present in IPF, oxygen desaturations are more profound. The therapy of sleep disorders and sleep disordered breathing in IPF is individual. But in the absence of an effective treatment of IPF, optimization of sleep and life quality by the treatment of sleep disorders seems to be a primary goal. Further studies are needed to determine special sleep-related treatment effects.

Key words: breathing, idiopathic pulmonary fibrosis, sleep

INTRODUCTION

Idiopathic pulmonary fibrosis (IPF) is the most common type of idiopathic interstitial pneumonias (1), which are part of the group of diffuse parenchymal lung diseases (DPLD). The DPLDs are a heterogeneous group of more than 150 entities which were called 'interstitial lung diseases' in the past. Lung fibrosis often represents the end stage of these diseases. Four groups of DPLD can be differentiated (2):
- DPLD of known cause (e.g., drugs or association, collagen vascular disease)
- idiopathic interstitial pneumonias (e.g., IPF)
- granulomatous DPLD (e.g., sarcoidosis (3))
- other forms of DPLD (e.g., eosinophilic pneumonia, LAM, HX)

The prognosis of IPF patients is poor. The typical symptoms dyspnea and cough are progressive, 50% of the patients die within 3 years after diagnosis. The effect of pharmacological treatment is disappointing (1). Most of the studies, however, deal with diagnostics and treatment during wakefulness, although many patients suffer from daytime fatigue and other symptoms of sleep disorders (5). Clinical importance of sleep quality and sleep-related disorders of breathing in IPF has only been investigated in a small number of studies. The following paper attempts to summarize the actual knowledge about sleep and breathing in IPF.

SLEEP DISORDERS IN IDIOPATHIC PULMONARY FIBROSIS

Sleep disorders with sleep fragmentation are very common in IPF. Coughing with arousals, nocturnal oxygen desaturations and increased respiratory drive are discussed as possible reasons (6). Earlier studies in IPF patients show increased NREM stage 1/2 sleep, decreased REM-sleep, and a certain amount of nocturnal oxygen desaturation (7, 8). A recent study again proves that poor sleep quality and daytime sleepiness are extremely common in patients with IPF and that this is associated with poor quality of life. Poor sleep quality, however, is not associated with the degree of lung function impairment (9). Another prospective, controlled study demonstrates a decrease in sleep efficiency and slow wave sleep and an increase in NREM stage 1 sleep and arousal index, with a consequent impairment of physical and social functioning (5). In that study all patients suffered from daytime fatigue, 20% of them from excessive daytime sleepiness, and half from symptoms of insomnia. Patients spent more than one third of the night on oxygen saturation below 90%. Breathing frequency during wakefulness was increased, but did not decrease significantly during sleep. The best correlation between fatigue scores and the features of polysomnography (PSG) was found between the Fatigue Severity Scale (FSS) score and the mean oxygen saturation during sleep ($r=0.80$, $P<0.0001$). In general, however, there was no close correlation between the different fatigue scores and PSG features.

SLEEP-RELATED DISORDERS OF BREATHING IN IDIOPATHIC PULMONARY FIBROSIS

In the International Classification of Sleep Disorders (ICSD-2), the sleep-related breathing disorders in IPF are allocated to the group of 'sleep disorders with sleep-related hypoventilation and hypoxemia in parenchymal or vascular lung diseases' (6, 10, 11). The typical nocturnal pulse oximetry curve of a patient with severe IPF has specific patterns: Beside a low niveau of oxygen saturation...
during night, there are additional phasic desaturations due to hypoventilation like in COPD. The criteria of the ICSD-2 for the diagnosis of sleep-related breathing disorders in IPF and DPLD are presented in Table 1. It is obvious, that these criteria are adopted from those concerning the sleep breathing disorders in COPD.

Table 1. Diagnostic criteria for sleep-related disorders of breathing in diffuse parenchymal lung diseases. At least 1 criterion has to be met to diagnose the breathing disorders (10, 11).

- \( \text{SaO}_2 \) during sleep <90% for >5 min, with a decrease ≤35 %
- \( \text{SaO}_2 \) during sleep <90% during >30% of the total sleep time
- \( \text{PaCO}_2 \) during sleep abnormally high or its disproportional increase in comparison with the wake-\( \text{PaCO}_2 \).

Anyway, several studies show that nocturnal hypoxemia is often present in DPLD and that these desaturations may lead to sleep fragmentation and impairment of sleep quality (5, 7, 8, 12, 13). The desaturations are, however, not as profound as during exercise (14). The breathing frequency in these patients is lower compared with that during wakefulness, but it is still increased due to increased respiratory drive (7, 12). Patients show, rapid shallow breathing' during sleep (15). Prediction of nocturnal oxygen saturation is possible on the basis of the level of the \( \text{PaO}_2 \) during wakefulness, but not of lung function parameters, such as vital capacity (16). The frequency and the importance of hypoventilation during sleep are still unclear (17). Due to increased respiratory drive, hypoventilation seems to appear only in the late course of the disease, but there is a group of patients with reduced ventilatory drive and an early tendency to hypoventilation during sleep (6, 17).

Obstructive sleep apnea is not more frequent in IPF than in the general population with the exception of patients with an increased body mass index (7, 18). If obstructive sleep apnea is present in IPF during sleep, oxygen desaturations are much more profound than in isolated sleep apnea.

THERAPEUTIC AND FUTURE SCIENTIFIC ASPECTS OF IDIOPATHIC PULMONARY FIBROSIS FROM THE PERSPECTIVE OF SLEEP MEDICINE

Treatment of sleep-related breathing disorders in IPF is based on oxygen and pressure support therapy (CPAP, BiPAP, NIV, etc.) dependent on the polysomnographic findings. The therapeutic approach, however, is individual, since there are no evidence based recommendations (19). But in consideration of the lack of an effective general therapy in IPF the improvement of sleep and breathing during sleep could be a reasonable addition in the management of the disease (18).

Besides the development of disease related diagnostic criterions for sleep-related breathing disorders in IPF, the scientific work should focus on the improvement of sleep quality and breathing during sleep in these patients. Especially, therapeutic aspects, such as the effect of antitussive therapy, oxygen or non-invasive ventilation on sleep and breathing should be investigated in controlled studies.

Conflict of interests: None declared.

REFERENCES


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