Obstructive sleep apnoea (OSA)- A multi system disease

Intermittent hypoxemia causes abnormal metabolic response

OSA primarily affects the respiratory system during sleep by compromising upper airway and limiting air and oxygen flow into the lungs. Apnoea is defined as cessation of airflow for ≥ 10 seconds and hypopnoea is defined by a drop of ≥30% in air flow for ≥10 seconds associated with ≥3% oxygen desaturation. Averaging the number of apnoeas and hypopnoeas in one hour of sleep study is called AHI (apnoea hypopnoea index) which is used to determine the severity of the disease as below:

AHI<5: Normal

AHI 5-15: Mild disease

AHI 15-30: Moderate disease

AHI>30 Severe OSA

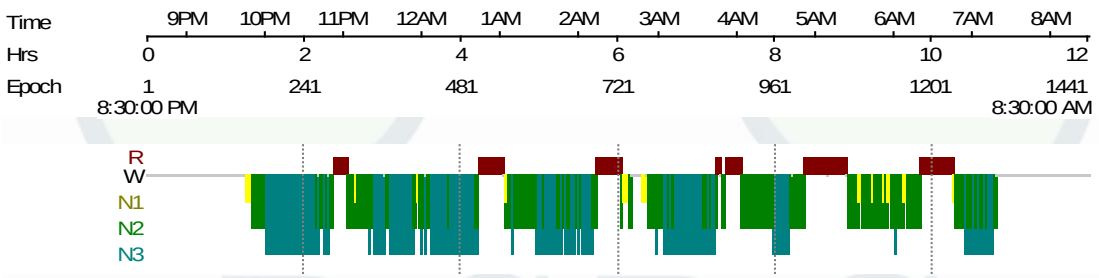
Apnoea and hypopnoea events cause intermittent hypoxaemia (IH), then the temporary increase in the oxygen saturation after an event of IH is associated with production of oxygen free radicals (oxidative stress). These free radicals act as pro-inflammatory mechanism and are associated with metabolic abnormalities, like fat gain, high cholesterol, hypertension, diabetes and neurocognitive impairment. In case of severe OSA, the patient is predisposed to higher cardiovascular and cerebrovascular co-morbidities, increased mortality and shorten life span. As OSA events are associated with brief arousals from sleep, quality of sleep is affected. Poor sleep quality due to lack of oxygen and/or frequent wake ups, is associated with neurologic and psychiatric disorders like, poor concentration, memory loss, depression and anxiety. Poor sleep quality causes significant sleepiness and tiredness during the day, which may be associated with poor performance and car accidents. Hence OSA is a multi-system disease.

Some of the clinical indications that may initiate investigations include: snoring, pauses in breathing or awakenings at night with gasping or choking events, multiple nocturia, poor sleep quality, sleepiness, tiredness or being fatigued during the day, motor vehicle accidents, poor memory or concentration, obesity, metabolic syndrome, difficult to treat hypertension, upper airway abnormality for example small jaw, large tonsils or retrognathia. Screening tools may be useful in evaluation of symptomatic patients or in preoperative assessment. One of these tools is STOP-BANG questionnaire which includes **s**noring, **t**iredness, **o**bserved apnoeas, blood **p**ressure, **B**MI, **a**ge, **n**eck circumference, and **g**ender. A score more than 3 has a reasonable sensitivity for the screening of at least mild OSA.

Sleep study

A sleep study is usually used to diagnose this condition. Although in-laboratory sleep study is the gold standard test in the diagnosis of OSA, home based sleep study is reasonable for diagnosis of suspected moderate-severe OSA in patients with no other significant co-morbidities. Sleep studies are reported by sleep physician, who summarises the findings in the conclusion section. However, it would be useful for the general practitioner to extract results from the study. This will help the practitioner to discuss the results with the patient in more depth and be involved in the future treatment planning.

Hypnogram is a summary of the EEG recordings during sleep. It is provided in the sleep study report and demonstrates different stages of sleep shown in different colours. Normal sleep contains Non-REM (NREM) and REM phases. NREM sleep has 4 stages, but its stage 3 and 4 are combined together to demonstrate slow wave (deep) sleep. Hence hypnogram contains stage 1 NREM sleep (yellow), stage 2 NREM sleep (green), stage 3 NREM sleep (blue) and finally REM sleep (red). As shown in this figure for example, the subject had good quality of sleep and slept from before 10 pm until after 7 am with rare wake events, had good amount of deep (slow wave) sleep shown as blue bars and had several REM periods (red bars).



It would also be useful to look at oxygen saturation trace. This will indicate the frequency and extent of hypoxaemia events. The clinician can also correlate the degree of hypoxaemia to a particular stage of sleep or to the position in which the subject sleeps. This is useful in understanding hypoventilation syndrome which is mainly seen during REM period of sleep. As you can see below, the patient only experiences significant hypoxaemia during supine sleep.

Sleep studies also contain a brake down of AHI based on body position (supine or non-supine) and different periods of sleep (NREM vs REM).

Treatment of sleep apnoea is dependent on different factors like the severity of the condition, patient symptoms, associated co-morbidities and physical examination findings. Life style changes and weight loss (if relevant) are always discussed with the patient. OSA directed therapies like positive airway pressure (PAP) devices or mandibular advancement splints (MAS) are used in many patients with OSA who require treatment. Other OSA treatments are recommended in selected cases.

Dr Ali Aminazad MD FRACP FCCP MClinResMeth
Director RSDC (Respiratory Sleep Disorder Centre)
Consultant Respiratory and Sleep Specialist Eastern Health
Adjunct Lecturer Monash University Melbourne