SQU Med J, November 2011, Vol. 11, Iss. 4, pp. 534-539, Epub. 25th Oct 11

2nd National Symposium on Sleep Medicine

Oman Respiratory Society and Sultan Qaboos University Hospital

4-5th May 2011

الندوة الوطنية الثانية لطب النوم

جمعية الجهاز التنفسي العُمانية ومستشفى جامعة السلطان قابوس

4–5 مايو 2011

Overview of Obstructive Sleep Apnoea including Historical Background, Pathophysiology and Clinical Presentations

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Obstructive sleep apnoea (OSA) is a common disorder characterised by repetitive narrowing or collapse of the pharyngeal airway during sleep. Estimates of disease prevalence are in the range of 2% to 4%, with certain subgroups of the population bearing higher risk. The disorder is associated with major co-morbidities including excessive daytime sleepiness and increased risk of cardiovascular disease. The underlying pathophysiology is multifactorial and may vary considerably between individuals. Important risk factors include age, male sex, obesity, family history, menopause, craniofacial abnormalities, and certain health behaviours such as alcohol use. Despite the numerous advancements in our understanding of the pathogenesis and clinical consequences of the disorder, a majority of those affected remain undiagnosed. In this presentation, the historical background of obstructive sleep apnoea will be briefly covered. The current understanding of OSA pathophysiology in adults, the potential mechanisms underlying the principal risk factors and various clinical presentations of this disease will be discussed.

Diagnosis of Obstructive Sleep Apnoea

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Obstructive sleep apnoea (OSA) is a disorder characterised by obstructive apnoeas and hypopnoeas caused by repetitive collapse of the upper airway during sleep. According to American Academy of Sleep Medicine, the Criteria for definition of obstructive apnoea are (all 3): 1) Cessation of air flow; 2) continued respiratory effort, and 3) apnoea lasting 10 seconds or longer. A central apnoea occurs when both airflow and ventilatory efforts are absent. Mixed apnoea occurs when there is an interval during which there are no respiratory efforts and an interval during which there are obstructed respiratory efforts. Diagnosis of OSA is suspected from history and physical examination and confirmed by a sleep study using polysomnography (PSG). Snoring and excessive daytime sleepiness are the most important symptoms. Interestingly, it has been noted that women report symptoms of OSA less frequently. The Epworth Sleepiness scale (ESS), a subjective test, measures sleepiness as it occurs in ordinary life situations. It can be used as a screening test for excessive sleepiness, or to follow an individual's subjective response to an intervention. Physical examination is frequently normal. Obesity and crowded oro-pharynx are the most important findings. Hypertension or uncontrolled hypertension is also a significant observation. The Mallampati score (MS) is an important tool to assess the upper airway; MS 3 and 4 have good sensitivity and specificity. The differential diagnosis of OSA include periodic limb movements of sleep, sleep pattern of rotating shift workers, narcolepsy, upper airway resistance syndrome and simple snoring. For diagnosis, full-night or split-night, attended, in-laboratory polysomnography is suggested for most of the patients. Unattended portable monitoring is an alternative test for patients in whom there is a high likelihood of moderate or severe OSA. The severity of OSA is graded using the Apnoea Hypopnoea Index (AHI) which equals the number of apnoeas and hypopnoeas occurring per hour of sleep. AHI of 5–15 defines mild OSA, 15–30 moderate OSA and AHI > 30 severe OSA.

Complications of Obstructive Sleep Apnoea/Hypopnoea Syndrome

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The obstructive sleep apnoea/hypopnoea syndrome (OSAHS) is a common disorder, affecting around 2–4% of the middle-aged population. There is a strong association between OSAHS and hypertension, ischaemic heart diseases stroke and type 2 diabetes. Different mechanisms play a role in the process of developing complications in OSAHS.

Sympathetic activity is increased in OSAHS patients during sleep and wakefulness. This increase in sympathetic activity is probably due to activation of baroreflexes and chemoreflexes by frequent arousals and also due to hypoxaemia resulting from apnoea or hypopnoea events. Altered endothelial function may also have a role in the pathogenesis of hypertension as well as cardiovascular and cerebrovascular diseases in OSAHS subjects. Reduction of nitric oxide production and increase in the formation of free radicals may be responsible for the impairment of the vasodilatation of micro-vasculature in these subjects. Furthermore, disturbed sleep in obstructive sleep apnoea may cause insulin resistance and impaired glucose tolerance. Continuous positive airway pressure (CPAP) therapy has been shown to have a reversible effect on endothelial dysfunction and sympathetic hyperactivity. It has also been shown to improve insulin sensitivity and glucose tolerance in those patients who are compliant with the treatment.

Psychosocial and Economic Impact of Obstructive Sleep Apnoea

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Obstructive sleep apnoea (OSA) is a common under diagnosed disorder characterised by recurrent upper airway obstruction during sleep. The prevalence of OSA is estimated to be around 4% in middle aged men and 2% in females in the same age group. In addition to its numerous medical consequences, OSA has it is own effects on the psychosocial well being of the affected individuals and can adversely impact health care economics. Daytime sleepiness, one of the main symptoms of OSA, adversely affects cognition which impairs the work performance. It can also result in deficits in neurocognitive performance which in turn leads to errors while driving and result in increased risks of motor vehicle crashes, including a high rate of collisions in patients who drive as part of their occupation. In one of the studies, the risk of occupational accidents was found to be 50% higher in those with OSA compared to normal controls. OSA appears to cause a huge economic burden. The economic burden of OSA-related automobile collisions alone is enormous. To illustrate this, patients with sleep apnoea have a three to seven fold increased risk of motor vehicle crashes and CPAP reduces these risks substantially. Sassani et al. reported that in the year 2000 there were 810,000 collisions and 1,400 fatalities attributable to OSA in the USA with a total cost of 15.9 billion dollars. Treatment with CPAP would have prevented 567,000 of these crashes, saved approximately 1,000 lives, and resulted in an overall savings of 7.9 billion dollars after costs associated with treatment were taken into account. Untreated OSA leads to multiple medical problems (such as systemic hypertension, cardiovascular disease, injuries and mood disorders) that increase health care utilisation. Patients with sleep apnoea can consume 1.7 times more health care resources than controls matched for age, gender, area of residency and family physician. The total economic burden of sleep disorders in Australia (a country with a population of 20.1 million) was substantial: $7.494 billion in 2004. The financial costs, excluding the cost of suffering, were $4.524 billion, representing 0.8% of Australia's gross domestic product. CPAP therapy for OSA appears to reduce health care utilisation. More importantly, it is cost effective—more so than fluticasone for asthma and primary angioplasty after myocardial infarction as assessed by the incremental cost-effectiveness ratio (ICER), which is the ratio of the incremental cost and incremental change in quality-adjusted life years (QALY) that follows from the adoption of a treatment (CPAP in case of OSA).

Medical Treatment of Obstructive Sleep Apnoea

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Obstructive sleep apnoea is a disease characterised by obstructive apnoeas and hypopnoeas due to upper airway collapse. Medical therapy involves mainly the use of continuous positive airway pressure (CPAP) devices that basically work by blowing air into the upper airways under constant pressure to prevent or correct the collapse of the airways during sleep. There is high quality evidence that CPAP therapy improves daytime sleepiness, cognitive function and quality of life. Treatment also improves the cardiovascular consequences of OSA. CPAP machines either deliver a constant pressure throughout the night (fixed CPAP), or variable pressure depending on a specific algorithm (auto CPAP). There is no consensus on the optimal duration for using CPAP, but use for more than five hours every night is preferred. Compliance with CPAP therapy remains an issue with most patients having poor adherence. This might be improved with proper patient counselling and trial of various forms of masks that will fit the particular patient best. Medical therapy in terms of using pharmacological agents has not been shown to be effective; however, it can be used as an adjunctive therapy in patients who continue to have daytime sleepiness despite proper and adequate use of CPAP.

Role of Oral and Maxillofacial Surgery in the Management of Obstructive Sleep Apnoea

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Oral and maxillofacial specialty plays an important role in the management of patients with sleep apnoea. The oral and maxillofacial surgeon can screen the patients in the outpatient clinic, manage associated orofacial symptoms (bruxism, tempero mandibular disorders, etc), provide mandibular advancement devices and offer maxillofacial surgeries to improve the airflow at the oropharynx area. Usually patients are referred to the maxillofacial surgeon after the diagnosis and severity of their apnoea are established by a sleep study. In addition, endoscopic airway assessment by an ENT

surgeon confirms the obstructive nature of the apnoea and will define its level (nasal, palatal, tongue). A mandibular advancement device (MAD) is made of acrylic and keeps the mandible in forward relation to the maxilla. This opens the posterior airway at the level of the tongue base. The device is worn during sleep and most of the patients tolerate it well. It is useful in the management of mild to moderate obstructive sleep apnoea and in patients who snore. This is an alternative for patients who cannot tolerate continuous positive airway pressure (CPAP). It is gaining popularity because of its simplicity and reversibility. Recent reviews show a positive outcome in 60–75% and superior results when compared to upper airway surgery. Most commonly performed maxillofacial surgeries are genioplasty (chin advancement), mandibular advancement osteotomy, maxillomandibular advancement (MMA) and distraction osteogenesis (DO). These surgical procedures are based on the fact that soft tissues follow the bone. Bringing the jaws surgically forward will bring with it associated soft tissues (tongue base or soft palate), which in turn will open the airways. These are now routine procedures in the Oral and Maxillofacial Surgery Unit at Al Nahdha Hospital with good and predictive results. Finally, close interaction between the respiratory physician, ENT surgeon and oral and maxillofacial surgeon will secure optimal results in the management of patients with sleep apnoea.

Surgical Approach for Obstructive Sleep Apnoea

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Obstructive sleep apnoea (OSA) syndrome is a potentially serious disorder affecting millions of people around the world. It involves periodic partial or total collapse of the pharyngeal airway during sleep. This results in progressive asphyxia, which increasingly stimulates breathing efforts against the collapsed airway, typically until the patient is awakened from sleep. The intention of surgery in OSA is to open the airway sufficiently to eliminate or to reduce obstructions to a clinically insignificant level. The most commonly performed procedures include nasal reconstruction, adenotonsillectomy, uvulopalatopharyngoplasty (UPPP), advancement genioplasty, mandibular osteotomy with genioglossus advancement, and hyoid myotomy and suspension. In more severe cases, maxillomandibular advancement (MMA) with advancement genioplasty or even tracheostomy may be indicated. In OSA, the success of surgery is generally measured by achieving a respiratory disturbance index (RDI) of less than 5, improvement of oxygen saturation to 90 per cent or more and quality of life improvements with elimination or significant reduction of OSA symptoms. It is extremely difficult in practice to achieve these goals without the cooperation of the patient, especially weight loss and maintenance of a healthy lifestyle. Finally, continuous positive airway pressure (CPAP) is the gold standard treatment for OSA, surgical management only being an adjuvant.

Insomnia, Assessment and Treatment

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Insomnia is the most prevalent sleep disorder in the general population and is commonly encountered in medical practices. Its prevalence is estimated to be around 20%. Insomnia is defined as a subjective perception of difficulty with sleep initiation, duration, consolidation, or quality that occurs despite adequate opportunity for sleep leading to some form of daytime impairment. Insomnia may present with a variety of specific complaints and aetiologies, making the evaluation and management of this disorder demanding on a clinician's time. In this presentation, the epidemiology, risk factors, pathophysiology, and consequences of insomnia will be briefly discussed. The different types of insomnia, its evaluation and available effective treatments will also be highlighted.

Non-Invasive Ventilation: Practical aspects

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Noninvasive ventilation (NIV) is a form of assisted ventilation without an invasive artificial airway. It is now increasingly used in the first line management of both acute and chronic respiratory failure in the hospital as well as in the home setting. Ventilation is delivered through a noninvasive interface like a nasal mask, facemask, total face mask or nasal pillows. The key to the successful application of noninvasive ventilation is in recognising its capabilities and limitations. Patients who require immediate intubation should not be offered NIV. Relative contraindications include cardiac or respiratory arrest, inability to cooperate, inability to protect the airway or clear secretions, severely impaired level of consciousness, facial surgery, trauma or deformity, high risk for aspiration and recent oesophageal anastamosis. Many patients are provided with the most basic level of support, the continuous positive airway pressure (CPAP). CPAP may be especially useful in patients with pulmonary oedema or obstructive sleep apnoea. Bi-level positive airway pressure (BPAP) is probably the most common mode of support and requires provision of inspiratory positive airway pressure (IPAP) and expiratory positive airway pressure (EPAP) separately. Another mode, proportional-assist ventilation (PAV) provides flow and volume assistance with each breath. It is better to start with low pressure in spontaneously triggered mode with backup rate, applying 8 to 12 cm H2O of IPAP and 3 to 5 cm H2O of EPAP. The mask should be first held in place by the therapist to familiarise the patient with the flow. Then the straps should be applied to hold the mask in place, with care to minimise excess pressure on the face or nose. The pressures can then be gradually increased in increments of 2 cm H2O or as tolerated (IPAP 20-25 and EPAP 10-15 cm H2O maximum) to achieve alleviation of dyspnoea, decreased respiratory rate, increased tidal volume and a good patient-ventilator synchrony. Oxygen is supplemented as

needed to keep SaO2 around 90%. Subsequent adjustments are based on arterial blood gas values. If hypercapnia persists, IPAP and, if it is hypoxia, EPAP are increased. Once the acute event is tided over, weaning may be accomplished by progressively decreasing the amount of positive airway pressure, permitting the patient to be disconnected from the NIV for progressively longer durations, or a combination of both. Conditions known to respond well to this treatment include exacerbations of chronic obstructive pulmonary disease, cardiogenic pulmonary oedema and hypoxaemic respiratory failure and, in the chronic setting, obstructive sleep apnoea and chronic type II respiratory failure due to diverse causes. It is also useful in preventing post extubatuion respiratory failure and in selected cases of asthma exacerbations.

Sleep from an Islamic Perspective

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Sleep medicine is a relatively new scientific specialty. Sleep is an important topic in Islamic literature, and the Quran and Hadith discuss types of sleep, the importance of sleep, and good sleep practices. Islam considers sleep as one of the signs of the greatness of Allāh (God) and encourages followers to explore this important sign. The Quran describes different types of sleep, and these correspond with sleep stages identified by modern science. The Quran discusses the beneficial effects of sleep and emphasises the importance of maintaining a pattern of light and darkness. A mid-day nap is an important practice for Muslims, and the Prophet Muhammad peace be upon him (pbuh) promoted naps as beneficial. In accordance with the practice and instructions of Muhammad (pbuh), Muslims have certain sleep habits and these sleep habits correspond to some of the sleep hygiene rules identified by modern science. Details of how to sleep include sleep position—like encouraging sleep on the right side and discouraging sleep in the prone position. Dream interpretation is an established science in the Islamic literature and Islamic scholars have made significant contributions to the theories of dream interpretation. We suggest that sleep scientists examine religious literature in general, and Islamic literature in particular, to understand the views, behaviours, and practices of ancient people about sleep and sleep disorders. Such studies may help to answer some unresolved questions in sleep science or lead to new areas of inquiry.

Restless Leg Syndrome and Periodic Limb Movement

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Restless leg syndrome (RLS) is a chronic neurological disorder which is underreported; various reported prevalence rates range from 2–15%. Four diagnostic criteria are being identified in order to diagnose RLS, including an urge to move the legs associated with unpleasant sensation in the legs which begin or worsen at rest, in particular at night. The symptoms are relieved partially or completely by movement. It is at times associated with period limb movement (PLM) during sleep. RLS and PLM can lead to significant sleep disturbance and poor quality of life. Both conditions are chronic with 45% of patients experiencing their first symptoms before the age of 20. The frequency and severity of symptoms worsen with time and most of the patients will start feeling their symptoms on daily basis between the ages of 40–60. The pathophysiology is still not well understood, but the dopamine pathway system, brain iron metabolism and endogenous opioids system are being implicated. Most of the time, the aetiology is unknown. However, both RLS and PLM are reported in patients with anaemia, uraemia, and neuropathy. It is important to differentiate RLS and PLM from other conditions like akathisia, nocturnal leg cramps, painful legs and moving toes, peripheral vascular disease and peripheral neuropathy. There are various scales available to assess the severity and quality of life of these patients as well as how to quantify the symptoms in sleep laboratory. Most patients respond well to one of the dopamine agonists. In severe cases, other options may be considered including opioids and anitiepileptics.

Narcolepsy

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Narcolepsy is the second most common cause of disabling daytime sleepiness after sleep apnoea. Descriptions of the disorder appeared as early as 1862. The term narcolepsy was first applied by Gélineau to a clinical syndrome of daytime sleepiness with cataplexy, hypnagogic hallucinations, and sleep paralysis. The prevalence of narcolepsy with cataplexy is estimated to be 25–50 cases per 100,000. It is equally common in both genders. It typically begins in the teens and early twenties, but can occur as early as five years of age or after 40 years of age. The symptoms may worsen during the first few years and then persist for life. Narcolepsy is a disorder of sleep-wake state control in which elements of sleep intrude into wakefulness and vice versa. Only about one third of the affected patients will have the four classic symptoms of daytime sleepiness, hypnagogic hallucinations, sleep paralysis, and cataplexy. Thus diagnosis of narcolepsy should be considered even in patients with sleepiness alone. Patients with untreated narcolepsy typically have Epworth Sleepiness Scale (ESS) scores greater than 15. Loss of orexin signalling, genetic factors, and rare brain lesions can cause or contribute to narcolepsy. Diagnostic testing for narcolepsy includes an overnight polysomnogram (PSG) followed by a Multiple Sleep Latency Test (MSLT). The PSG evaluates sleep quality and can identify coexisting causes of sleepiness such as obstructive sleep apnoea, periodic limb movements of sleep, or REM behaviour disorder that are common in narcolepsy and may warrant specific treatment. MSLT is performed the day after the PSG. During the MSLT, the patient is given four or five opportunities to nap every two hours. On average, healthy subjects fall asleep in about 10 to 15 minutes, whereas people with narcolepsy often fall asleep in less than five minutes, providing objective evidence of their

sleep propensity. The naps of narcoleptics often include REM sleep, and the occurrence of two or more of these sleep-onset REM periods (SOREMs) is an essential feature in establishing the diagnosis of narcolepsy. Narcolepsy without cataplexy can be confirmed if a) chronic sleepiness is accompanied by a MSLT showing an average sleep latency less than eight minutes and/or at least two SOREMs and b) alternative aetiologies have been excluded by history, clinical examination and PSG (e.g., untreated sleep apnoea, periodic limb movements of sleep, insufficient sleep, or sedating medications). Patients with narcolepsy can benefit from a regular and adequate sleep schedule, scheduled daytime naps, avoidance of drugs that produce daytime sleepiness or insomnia, and joining a psychosocial support group. Coexisting sleep disorders need to be treated if present. Patients with sleepiness severe enough to require medication can be treated with stimulant medications, such as modafinil. REM sleep-suppressing drugs which can selectively inhibit the reuptake of norepinephrine or serotonin such as venlafaxine, atomxetine and fluoxetine may substantially reduce cataplexy with relatively few side effects.

Approach to Sleep Disorders in Children

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Identification of sleep problems in children is important because there is very strong evidence from the literature to suggest a link between sleep disorders and physical, cognitive, emotional, and social development. Children with neurodevelopmental problems, learning differences, or behaviour problems may be at heightened risk for sleep problems compared with the general paediatric population. Paediatricians, paediatric subspecialists, and other health care practitioners are in an ideal position to identify sleep problems and disorders in children. Parents may not volunteer information about their child's sleep, or they may not appreciate the potential relationship between sleep problems and daytime behaviour. For these reasons, clinicians should incorporate questions about sleep into routine health assessment for children of all ages. Sleep problems present most commonly in the outpatient setting, but the hospitalised child may develop sleep problems during an acute illness, or chronic sleep disorders may come to medical attention during hospitalisation. This presentation will discuss the approach to taking a structured sleep history, describe specific sleep problems that may present during childhood, and explain indications for further diagnostic testing. This will enable the participants to understand the basic parameters, epidemiology and classification of sleep disorders in children, know how to take a structured sleep history and explain indications for further diagnostic testing.

Sleep-Disordered Breathing in Children

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Children of all ages can have a sleep-disordered breathing (SDB), just like adults; however, there are some differences in the pattern of causes and symptoms. Sleep in children with sleep-disordered breathing is very different from sleep in normal children. The increase in upper airway resistance during sleep can be extreme, and can lead to a markedly increased work of breathing associated with snoring, obstructive sleep apnoea and/or obstructive hypoventilation resulting in sleep disruption, hypoxia, and hypercarbia. The definition of SDB in children and the range of manifestations including the most common cause adenotonsillar hypertrophy will be discussed in detail. Other causes such as generalised hypotonia, as in patients with Prader-Willi syndrome, congenital central hypoventilation syndrome, and finally the treatment of SDB in children including surgery and CPAP will also be discussed.

Parasomnias: Common sleep disorders in children

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Parasomnia is a common sleep problem in children. Parasomnia can be sub-classified into disorders of arousal from non-rapid eye movement (NREM) sleep and parasomnias associated with rapid eye movement (REM) sleep. Arousal disorders from NREM sleep consist of several common disorders in children such as confusional arousals, sleep terror and sleep walking. Parasomnias associated with REM sleep include a common disorder like nightmares and a rare condition in children such as REM sleep behaviour. These episodes can be precipitated by stress, sleep deprivation, anxiety and environmental noises. Diagnosis of parasomnia is done by obtaining a standard clinical history with emphasis on detailed description, timing, and response to intervention. There is no need for a sleep study in children with simple parasomnias. A referral to a sleep centre is indicated in children with unusual presentations, persistent parasomnia, violent behaviours or symptoms of other sleep disorders. Polysomnography may demonstrate precipitous arousals from slow-wave sleep. In addition, a sleep study can help to identify co-existing sleep disorders which could potentially precipitate arousals, e.g. obstructive sleep apnoea. Treatment is reassurance and good sleep hygiene in mild cases. This presentation will enable participants to define and classify parasomnias as well as to differentiate between parasomnias and seizure/epilepsy in children.

Acute Ventilatory Failure Complicating Obesity Hypoventilation: Update on a "Critical Care Syndrome"

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Obesity can result in serious complications, including obesity hypoventilation syndrome (OHS). OHS patients may present with acute-on-chronic ventilatory failure, necessitating acute care management. This presentation will discuss the recent literature on acute ventilatory failure in OHS patients. Obese subjects can develop acute hypercapnic respiratory failure (AHRF) and sleep hypoventilation due to disorders in lung mechanics, ventilatory drive, and neuro-hormonal and neuro-modulators of breathing. Although there are no clearly defined predictors for OHS patients who are likely to develop AHRF, most such patients are middle-aged (mid-50s), morbidly obese, and have daytime hypercapnia, hypoxaemia, and low serum pH values. Immediate ventilatory support, without sleep study confirmation, is necessary in most such patients. Patients with respiratory acidaemia (pH <7.30) or altered mental status may require intensive care unit monitoring. Non-invasive positive pressure ventilation (NIPPV) is the recommended initial ventilatory support which must be closely monitored. Prompt initiation of NIPPV reduces the need for invasive mechanical ventilation and rapidly improves the levels of blood gases. Obese patients with sleep hypoventilation have an increased risk of AHRF. Early diagnosis and implementation of NIPPV is recommended for these patients.

Central Sleep Apnoea

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Central sleep apnoea (CSA) occurs when both airflow and respiratory effort are absent. Recurrent central apnoeas are the main finding in central sleep apnoea syndrome (CSAS). These occur when the inhibitory input to the respiratory centre exceeds the excitatory input. CSAS is uncommon, occurring in approximately 4% of the population. The mechanism causing CSA is primarily related to removal of the wakefulness drive to breath as well as unmasking of a Pco2 sensitive apnoeic threshold. In normal sleep, the ventilation decrease and hence Pco2 level slightly rise. The main control of ventilation during sleep is through the Pco2 level. In patients with CSA, Pco2 levels decrease to below the apnoeic threshold leading to temporary cessation of breathing which in turn raises the Pco2 to the normal level when the ventilation starts again. CSA could occur physiologically at sleep onset, but most often is a pathological process. Causes include heart failure, stroke, brain stem disorders, congenital alveolar hypoventilation syndrome and muscle disorders. Clinically, patients present with features similar to obstructive sleep apnoea with poor sleep, morning headache, daytime somnolence and nocturnal shortness of breath. In sleep study, CSA is diagnosed when more than 50% of the apnoeic events are central. Management of CSA includes finding the underlying cause like heart failure, hypothyroidism, brain stem lesions or muscle disease and managing it. CPAP therapy is used if CSA is associated with a significant amount of obstructive apnoea. Patients with hypercapnic CSA will benefit from bi-level ventilation. Optimising the treatment of heart failure in patients with CSA will improve the associated sleep disordered breathing. The role of oxygen and respiratory stimulants is less clear.

Polysomnography

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Polysomnography (PSG) is an excellent tool for evaluating sleep and sleep related disorders which utilises multiple physiological measures. These include brain waves (EEG), ocular movements (EOG), skeletal muscle activities (EMG), respiratory monitoring (airflow, effort, snoring), cardiac activity (ECG) and pulse oximetry (SaO2). In addition, audio and video recordings are made during the test. PSG gives an opportunity to correlate a variety of events occurring in separate physiological systems during different sleep stages and wakefulness. Scoring of sleep stages (NREM – N1, N2, N3 and REM) and wakefulness can be performed with the help of EEG, EOG and Chin-EMG activities which can be recorded by means of small surface electrodes through a conductive medium (gel). Appropriate sensors are used to monitor respiration. This includes thermal sensors for oro-nasal airflow, strain gages for respiratory effort (chest/abdomen movements) and dynamic snore microphones for snoring signals. Alternatively, a nasal pressure transducer can be used to register nasal airflow and snoring. Leg movements can be monitored by recording tibialis anterior muscle activity (EMG). ECG monitoring is essential to detect abnormal arrhythmias and cardiac activity. Sleep disordered breathing (SDB) such as apnoeas and hypopnoeas can be detected by a series of abnormally diminished airflow or cessation of airflow for a minimum duration of 10 seconds. These need to be correlated with other physiologic variations (to fulfil the criteria) such as drop in SaO2, arousal in EEG and other skeletal muscle movements along with abnormally heavy snoring. Audio/video recording is always advised for a better understanding of different types of parasomnias and nocturnal seizures.