Obstructive Sleep Apnoea

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Disclosures

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* I have no relevant disclosures or conflicting interests.

Sleep Apnoea

* Prevalence
* Association with other disorders
* Diagnosis
* Treatment

Sleep Disorders

* Over 70 recognised sleep disorders
* Commonest:
  * Insomnia
  * Sleep Apnoea
  * Restless legs syndrome
  * Narcolepsy.

Sleep Disordered Breathing

* **Sleep Apnoea:**
  * Obstructive
  * Central
  * Mixed

* Obstructive Sleep Apnoea is the commonest.

OSA

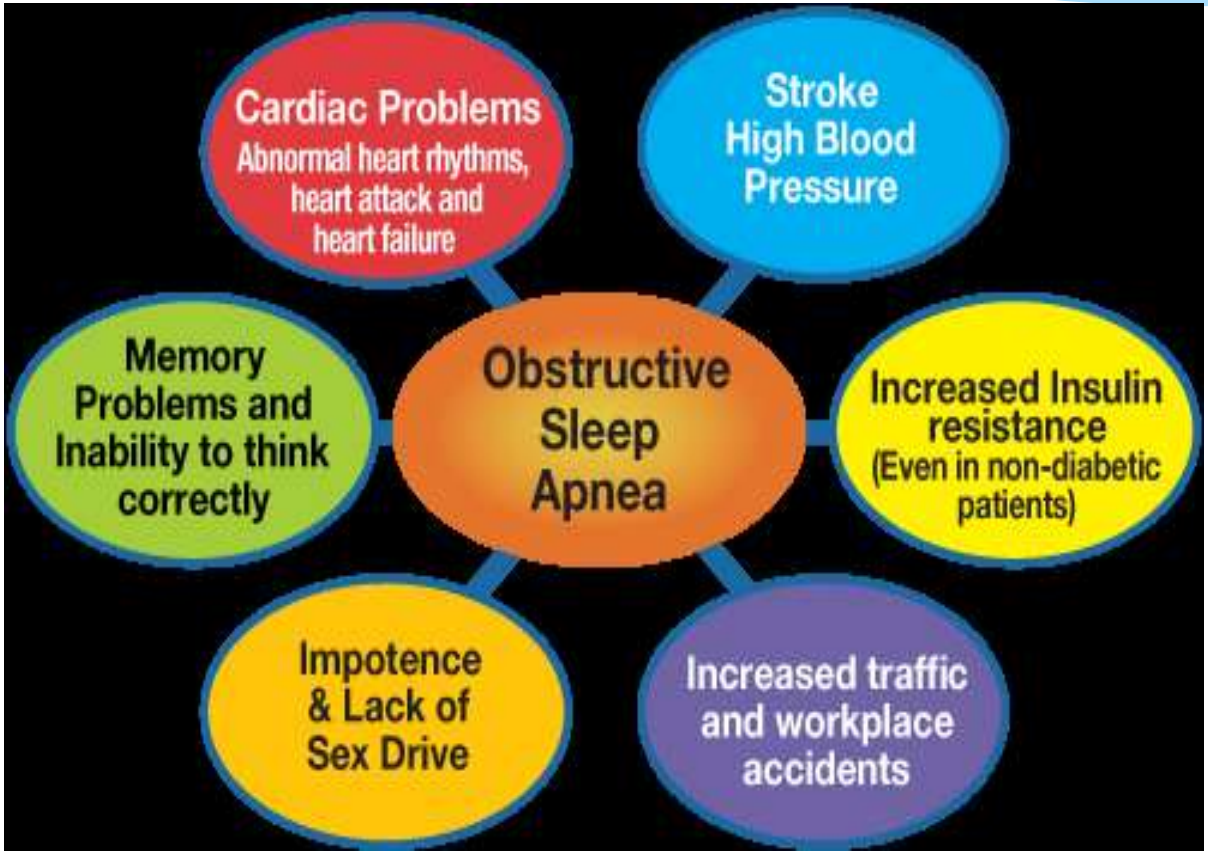
Sleep Apnoea

* Obstructive Sleep Apnoea
  * Is characterized by frequent episodes of upper airway collapse during sleep, causing recurrent arousals, intermittent hypoxaemia, sleep fragmentation and poor sleep quality. This results in irregular breathing at night and excessive sleepiness during the day.

Obstructive Sleep Apnoea

* Largest chronic illness in the USA.
* 24% of adult males and 9% of adult females are affected.
* >30 million individuals.

Obstructive Sleep Apnoea



Obstructive Sleep Apnoea

* 50,000 preventable deaths per year from accidents, heart attack and strokes (US).
* Inestimable toll on job productivity, family life

OSA and other conditions

* There is accumulating evidence that OSA is an independent risk factor for many other diseases:-
  * Hypertension – Systemic and Pulmonary.
  * Cardiac disease – Arrhythmias, Coronary artery disease and Cardiac Failure.
  * Cerebrovascular disease – Stroke
  * Diabetes and impaired glucose tolerance.
  * Hypercholesterolaemia
  * Glaucoma.
  * Fibromyalgia.
  * Depression.
  * Erectile dysfunction.
  * Cognitive disorders – memory impairment.
  * ADHD.
  * Alzheimers.
  * GERD.
  * Gout.

Characteristics of OSA

* Snoring, interrupted by pauses in breathing.
* Gasping or choking during sleep
* Restless sleep
* Excessive sleepiness or fatigue during the day
* Morning headache
* Sexual dysfunction
* Frequent urination at night
* Unrefreshing sleep
* Memory loss
* Irritability
* Poor judgement or concentration
* Large neck size >17” in men; >16” in women)
* Crowded airway

Risk factors for OSA

* Cross sectional surveys show that:
  * Obesity (particularly central obesity) is the strongest risk factor for OSA;
  * Male gender – 24% men v. 9% women have abnormal overnight PSGs.
  * Age.
  * Ethnicity - Hispanic and Black populations are at greater risk than Whites.

Polysomnography

Sleep Studies

* Overnight, in-house study, recording pulse rate, oxygen saturation, ECG, EEG, nasal air flow, thoracic excursion, EOM myography, leg movements, snoring and video with trained technician reporting is the gold standard.

* Split night studies with PSG recording for the first half of the night followed by CPAP titration during the second half is an alternative.

Sleep Studies

* Other approaches include:
* Home based studies with level three equipment.
* Overnight oxygen saturation monitoring.

OSA - Severity

* Severity: The severity of OSA is determined by the apnea hypopnea index (AHI) which is a measure of the number of periods of obstructed breathing per hour of sleep.
  * Normal AHI - < 5 events/hr.
  * Mild AHI - 5 – 15 events/hr.
  * Moderate AHI – 15-30 events/hr.
  * Severe AHI – 30-45 events/hr.
  * V. Severe AHI - >45 events/hr.

OSA and Cardiovascular Disease

* In a study of more than 3 million US veterans, untreated obstructive sleep apnoea was associated with:-
  * - 3.5 times higher risk of coronary heart disease
  * - 3.5 times higher risk of incident strokes.
  * - 2.27 times higher risk of kidney disease.

* Molnar MZ, et al "Association of incident obstructive sleep apnoea with outcomes in a large cohort of US veterans" Thorax 2015; DOI: 10.1136/thoraxjnl-2015-206790.

OSA and Hypertension.

* A prospective cohort study of 1889 OSA patients without hypertension were followed between 1994 and 2011 (21003 person years) 705 cases (37.5%) of incident Hypertension were noted.

* Compared with controls, the adjusted Hazard Ratios for incident hypertension were greater among patients with OSA ineligible for CPAP therapy (1.33; 95% CI, 1.01-1.75), among those who declined CPAP therapy (1.96; 95% CI, 1.44-2.66), and among those non-adherent to CPAP therapy (1.78; 95% CI, 1.23-2.58), whereas the HR was lower in patients with OSA who were treated with CPAP therapy (0.71; 95% CI, 0.53-0.94).

* Compared with participants without OSA, the presence of OSA was associated with increased adjusted risk of incident hypertension; however, treatment with CPAP therapy was associated with a lower risk of hypertension.

Association between treated and untreated obstructive sleep apnea and risk of hypertension.
Marin JM, et al. JAMA. 2012 May 23;307(20):2169-76. doi: 10.1001/jama.2012.3418.

Sleep and Hypertension

* **BP "Dipping"** refers to the fall in blood pressure – 10 -15% reduction in systolic and diastolic BP during sleep that occurs in normal individuals. This reduction coincides with the sympathetic withdrawal and subsequent parasympathetic predominance that occurs when going from wake to non-rapid eye movement (NREM) sleep.

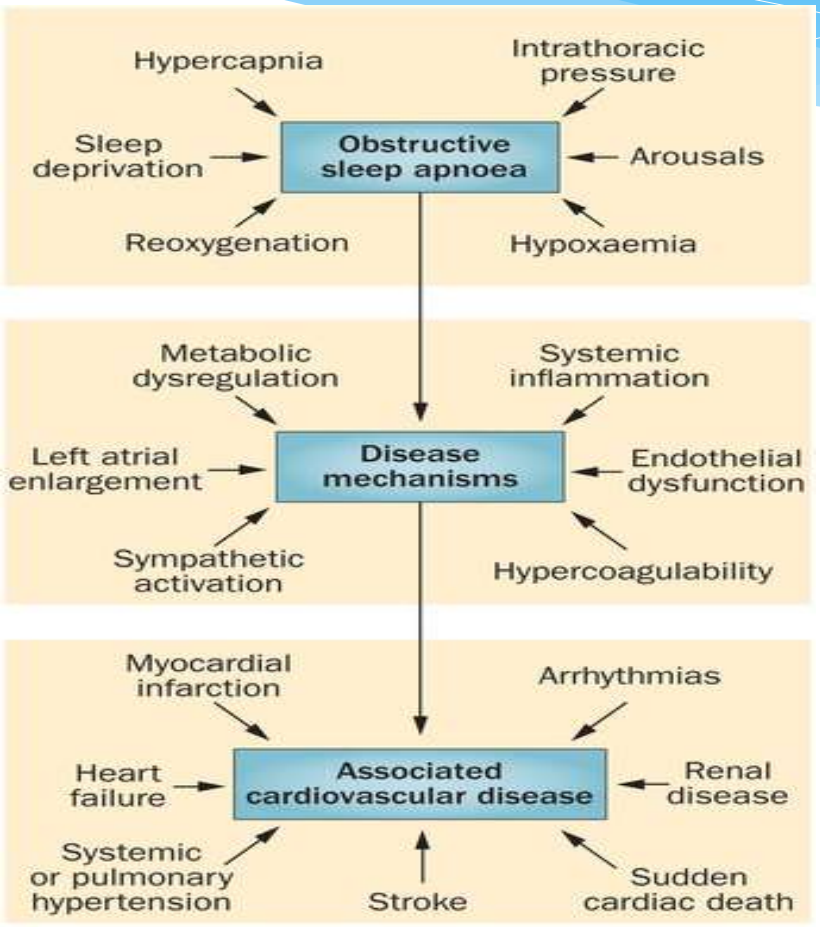
* **"Non-Dippers"** Absent or diminished nocturnal dipping of BP has been shown to be a strong independent predictor of cardiovascular risk.
* In the Ohasama study of 1464 individuals, it was shown that nighttime, as well as daytime BP measured by 24 hour ambulatory blood pressure monitoring (ABPM), were linearly related with stroke risk.
* In addition, in the Anglo-Scandinavian Cardiac Outcomes Trial, increased nighttime systolic BP (SBP) was associated with an increased risk of cardiovascular events.

* Ohkubo T, Hozawa A, Nagai K, et al. Prediction of stroke by ambulatory blood pressure monitoring versus screening blood pressure measurements in a general population: the Ohasama study. J Hypertens. 2000;18(7):847–854.
* Dolan E, Stanton AV, Thom S, et al. Ambulatory blood pressure monitoring predicts cardiovascular events in treated hypertensive patients – an Anglo-Scandinavian cardiac outcomes trial substudy. J Hypertens. 2009;27(4):876–885.

OSA and Atrial Fibrillation

* In the Sleep Heart Health Study, patients with severe OSA (apnea/hypopnea index [AHI] > 30 events/hr) had a 4-fold increased risk for AF (odds ratio, 4.02; 95% confidence interval, 1.03-15.74).
* The presence of untreated OSA seems to decrease the efficacy of drug cardioversion, electrical cardioversion, and catheter ablation.
* Treatment of OSA with CPAP decrease the frequency of recurrences of AF.

OSA and Cardiovascular Disease - mechanisms.



Nature Reviews | Cardiology

OSA and Disorders of Glucose Metabolism - Epidemiology

* Population studies suggest that up to 40% of patients with OSA will have diabetes, but the incidence of new diabetes in patients with OSA is not known.
  * N. Meslier, F. Gagnadoux, P. Giraud, et al., Impaired glucose-insulin metabolism in males with obstructive sleep apnoea syndrome, Eur. Respir. J. 22 (2003) 156–160.

* Likewise, in patients who are known to have diabetes, the prevalence of OSA may be up to 23%.
  * S.D. West, D.J. Nicoll, J.R. Stradling, Prevalence of obstructive sleep apnoea in men with type 2 diabetes,
    Thorax 61 (2006) 945–950.

Links between Obstructive Sleep Apnoea (OSA) and Diabetes (DM).

* Sleep symptoms & DM:
  * Snoring –
  * Short and long duration of sleep –
    * Both are independent risk factors for the development of DM over 10 years.

* PSG diagnosed OSA & DM
  * One study observing that 86% of obese type 2 diabetics had an AHI >5 /hour, indicative of mild OSA.
  * The Sleep Heart Health Study showed a significant association between oxygen desaturation during sleep and elevated fasting and 2-h plasma glucose concentrations during an oral glucose tolerance test (OGTT).

* N.M. Punjabi, E. Shahar, S. Redline, et al., Sleep-disordered breathing, glucose intolerance, and insulin resistance: the Sleep Heart Health Study, Am. J. Epidemiol. 160 (2004) 521–530.

OSA and Diabetes complications

* In T2DM, OSA is independently associated with:
  * Peripheral neuropathy
  * Macular oedema/diabetic retinopathy
  * Reduced skin blood flow/ulcers
  * High cardiovascular mortality and morbidity
  * High blood pressure

OSA and Stroke

* The Busselton Health Study, a 20 year follow-up study of 397 adults with moderate to severe OSA showed that participants:
  * 4 times more likely to die
  * 3.7 times more likely to have a stroke
  * 3.4 times more likely to die of cancer

  Adjusted for confounding factors of BMI, smoking, hypertension and raised cholesterol.

Marshall, N. S., Wong, K. K., Cullen, S. R., Knuiman, M. W., & Grunstein, R. R. (2014). Sleep Apnea and 20-Year Follow-Up for All-Cause Mortality, Stroke, and Cancer Incidence and Mortality in the Busselton Health Study Cohort. Journal of Clinical Sleep Medicine. doi:10.5664/jcsm.3600

OSA and other disorders

* Obesity
* Glaucoma
* Fibromyalgia
* Liver disease – Non alcoholic fatty liver disease
* Restless leg Syndrome
* Motor Vehicle and Industrial Accidents
* Cognitive disorders – Memory impairment
* Sexual problems – Erectile Dysfunction

Obesity

* Adults with OSA are typically centrally obese, and although this obesity is strongly causally linked to the condition, there is an increased prevalence of cardiovascular morbidity and mortality amongst OSA sufferers above what would be expected from obesity alone.

OSA and Glaucoma

* Normal tension glaucoma:
  * Risk factors:- abnormal ocular blood flow, abnormal blood coagulation, systemic hypotension, ischemic vascular disorders, and autoimmune diseases. Pathogenesis still not clear.
* 24 patients with NTG and 24 matched controls had PSG, 10 of the patients (41.7%) and 3 of the controls (12.5%) had OSA. ($p<0.05$)

* OSA may compromise optic nerve head perfusion and cause glaucomatous optic neuropathy by creating transient hypoxemia and increasing vascular resistance.

OSA and Fibromyalgia

* Rosenfield showed that 45% of patients with Fibromyalgia had symptoms of excessive sleepiness and abnormal PSGs.

* There are case reports of symptomatic fibromyalgia resolving completely with CPAP treatment.

Driving and Sleepiness

* National Sleep Foundation (US) 2005 study – 60% of drivers report having felt drowsy whilst driving. 37% (103 million people) reported having fallen asleep at the wheel.

* National Highway Traffic Safety Administration data, up to 100,000 police-reported crashes annually involve drowsiness or fatigue as a principal causal factor, accounting for 1.5% of all crashes.

* National Safety Council (US) - the total cost of crashes due to drowsy driving is approximately $11.1 billion per year.

OSA and Accidents

* Drivers with OSA are 2.5 times more likely to have a motor vehicle accident.
* Risk of accident is reduced by 70% with CPAP treatment.
* Many countries are introducing legislation for long distance truck drivers to have PSGs.

OSA and Daytime sleepiness.

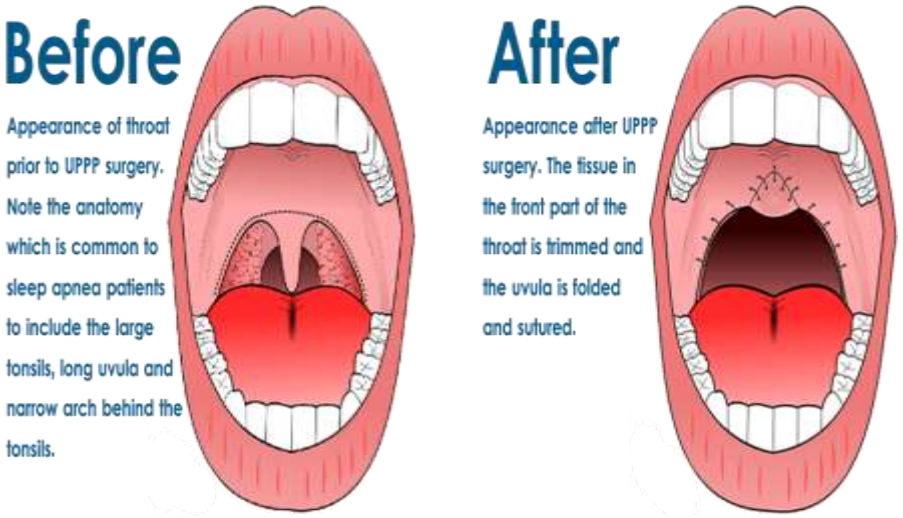
* February13, 2008 Mesa Airlines, Flight 1002, operating in the Hawaiian Islands - both the captain and first officer fell asleep during the flight.
* They flew 26 miles past their island destination into open ocean, and did not respond to air traffic controllers for more than 18 minutes. After normal communication was resumed, all three crewmembers and 40 passengers onboard arrived safely at their destination.
* The captain was found to have undiagnosed severe OSA.

Treatment of OSA

* Lifestyle changes
  * Weight loss
  * Limit alcohol
  * Avoid sedatives.

Treatment of OSA

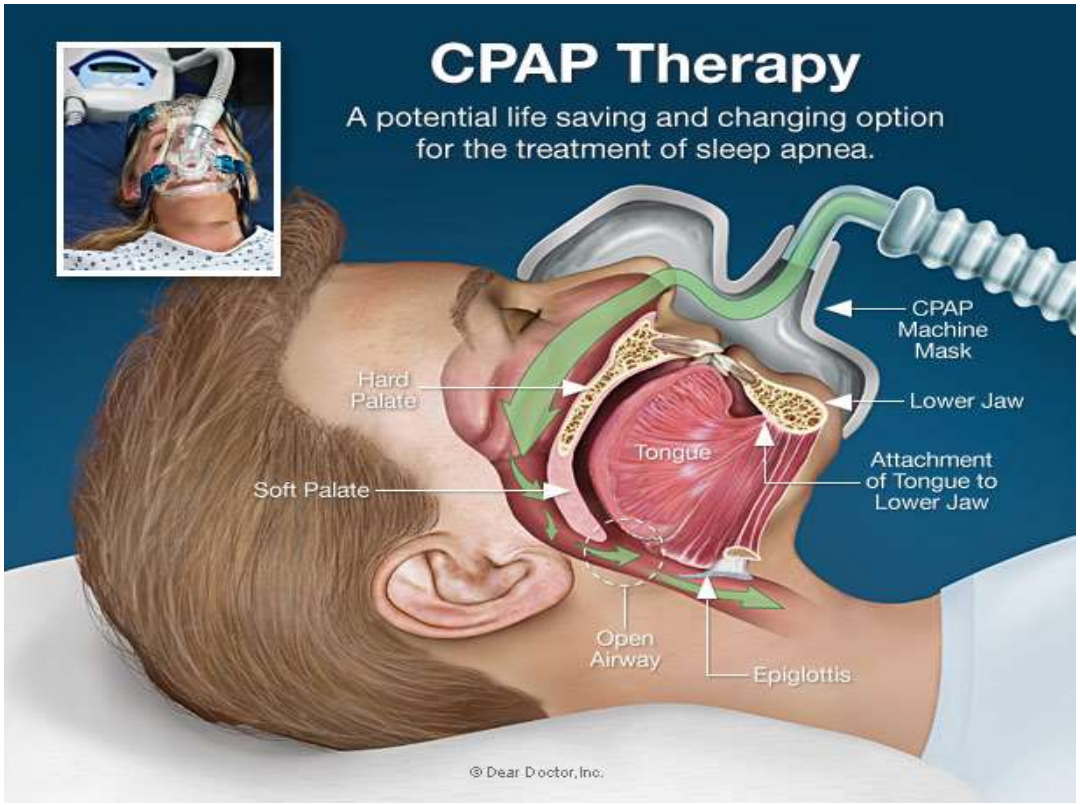
* Surgery
  * Tracheostomy – may be lifesaving.
  * T&A – more effective in children.
  * Uvulopalatopharyngioplasty – UPPP.
  * Maxillo-Mandibular Osteotomy.
  * Bariatric Surgery.



Treatment of OSA

* Other techniques and devices:
  * Mandibular advancement devices
  * Radiofrequency therapy
  * Soft palate implants

Continuous Positive Airways Pressure - CPAP



CPAP

Conclusion

* Obstructive sleep apnoea is a very common, under-recognised disorder.
* Diagnosis is simple but does require personnel and technology.
* Treatment is simple and very effective.
* OSA is the most rewarding disorder to treat.