Sleep breathing disorders

Dr Tariq
Learning objectives

Introduction to Sleep
Overview of obstructive sleep apnoea and Ix
Sleep apnoea and medical conditions
Other sleep disorders
Sleep apnoea and driving
Management of OSA
Referral criteria
Sleep

6.5-8.5 hours/24 hours
Sleep

Function

regeneration, dreaming, rest, memory formation, immune system, allows for decreased metabolic activity, brain metabolic restoration and survival
Types

REM 20-25%
   – reduced muscle tone, dreaming

Non-REM 75%-80% (1-4)
   – limb movement, sleep walking
REM

REM sleep period
- occurs about every 90 min
- lasts 20-30 min
- and becomes successively longer

Muscle tone is markedly reduced - flaccidity
Non-REM

Sleep starts with non-REM
Stages 1-4
Muscle tone reduced
Ventilation, HR, CO, BP all falls
Effects of sleep on human physiology

CNS - parasympathetic tone is increased
- sympathetic tone is variable

CVS - heart rate varies
- BP falls

Respiration - hypoventilation with reduced rate
- upper airway narrows increasing airflow resistance

GI - reduced acid production and emptying

Endo - GH & prolactin increase

Renal - reduced renal blood flow, GFR & UOP
Sleep disorders

It is estimated that 50% of the population suffers from some type of sleep disorder such as sleep apnoea, insomnia, narcolepsy, restless leg syndrome.
48 year old man

Presented with
Nocturnal cough, choking episodes
Waking up 2-3 times in night with dry mouth
Partner has seen him stopping breathing in sleep
Un-refreshed sleep
Excessive daytime sleepiness and tiredness
Partner finds it difficult to sleep because of the snoring
He slept at the wheel 18 months ago when he was driving from Newcastle

Non-smoker
Consumes 10u alcohol/week
PMH none
Medication none
BMI 34
Collar size 17
ENT examination normal
BP 148/92

ESS 13/24
TFT normal
Hb 14.7
Spirometry 3.12/3.93 (98%/119%)
    Normal flow volume loop
Does he have sleep related breathing problem? OSA or OSA syndrome?
Is it simple snoring?
Has his QoL/relationship been affected?
Should I refer him to sleep clinic?
Should I investigate him?
Should I treat him?
Should he stop driving?
Sleep apnoea

Central

Obstructive

Mixed
Sleep apnoea is part of the spectrum of sleep disordered breathing.
Definitions

Apnoea: total obstruction with 10s breathing pause

Hypopnea: partial obstruction with breathing reduced by >50% from baseline for >10s

Central apnoea: no mechanical breathing effort and no airflow for >10s

Sleep latency: time taken to go to sleep
OSA

4% of middle age men
2% of middle age women
1-2% children
Peak age 55-60 years
AHI: 6-14 episodes/hr = borderline OSA
    >15 episodes/hr = definite OSA
ODI: number of O$_2$ desaturation episodes of
    >3% from baseline/hr
Figure 1: Trends in hospital admission rates for sleep apnoea, England 1996-2004.

Source: Hospital Episode Statistics, DH
Snoring

Simple snoring

OSA without symptoms

OSA with symptoms (OSAS)
Simple snoring

1 in 3 men

1 in 10 women
Divorce
Separate beds
Being asked to leave hotels
Not being invited to stay overnight by friends
SYMPTOMS IN OBSTRUCTIVE SLEEP APNOEA

Common (>60%)
Loud snoring
Excessive daytime sleepiness
Feelings of choking or shortness of breath at night
Restless sleep
Un-refreshed sleep

Less common (10-60%)
Morning headaches
Reduced libido
Spouse worried by apnoeic pauses
Irritability

Depression

Loss of concentration

Lack of energy

Nocturnal confusion
Epworth Sleepiness Scale

How likely are you to doze off or fall asleep in the following situations?
Answer considering how you have felt over the past week or so.

0 = Would never doze
1 = Slight chance of dozing
2 = Moderate chance of dozing
3 = High chance of dozing

1. Sitting and reading
2. Watching TV
3. Sitting inactive in a public place (e.g., theater or meeting)
4. As a passenger in a car for an hour without a break
5. Lying down to rest in the afternoon when able
6. Sitting and talking to someone
7. Sitting quietly after a lunch without alcohol
8. In a car while stopped for a few minutes in traffic
Excessive daytime sleepiness

No night sleep
Depression, anxiety, Parkinson, drug
Shift work
OSA
Idiopathic hypersomnolence
Narcolepsy
Sleep study & overnight oximetry
5 channel

Oxygen saturation
Heart rate
Snoring recording
Position
Thoraco-abdominal movement - belt
Airflow
Polysomnography

EEG
EMG
ECG
EOG
Video
Leg movement
OSA and Medical Conditions
Obstructive Sleep Apnea

Cardiac Problems
Abnormal heart rhythms, heart attack and heart failure

High Blood Pressure

Memory Problems and inability to think correctly

Increased insulin resistance (Even in non-diabetic patients)

Stroke

Increased traffic and workplace accidents
OSAHS and Hypertension

Patient with OSAHS have significantly higher blood pressure than control

- Davies CW et al  Thorax 2000;55:726-8
Long-term cardiovascular outcomes in OSAS

Obstructive sleep apnea is independently associated with insulin resistance
Ip et al. Am J Respir Crit Care Med 2002; 165: 670-676

<table>
<thead>
<tr>
<th>AHI Stratum</th>
<th>Group I (≤ 5)</th>
<th>Group II (≥ 5 to &lt; 15)</th>
<th>Group III (≥ 15 to &lt; 30)</th>
<th>Group IV (≥ 30)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No., %</td>
<td>85 (31.5)</td>
<td>59 (21.9)</td>
<td>48 (17.8)</td>
<td>78 (28.9)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Male, no. (%)†</td>
<td>47 (55.3)</td>
<td>42 (71.2)</td>
<td>38 (79.0)</td>
<td>70 (89.7)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Smokers, no. (%)†</td>
<td>5 (5.9)</td>
<td>3 (5.1)</td>
<td>7 (14.6)</td>
<td>12 (15.4)</td>
<td>0.010</td>
</tr>
<tr>
<td>Drinkers, no. (%)†</td>
<td>5 (5.9)</td>
<td>1 (1.7)</td>
<td>3 (6.3)</td>
<td>8 (10.3)</td>
<td>0.236</td>
</tr>
<tr>
<td>AHI, no. of events/h†</td>
<td>2.3 (1.6)</td>
<td>9.3 (2.8)</td>
<td>20.6 (4.4)</td>
<td>50.2 (13.7)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Min O₂, %‡</td>
<td>88.3 (10.7)</td>
<td>82.1 (5.9)</td>
<td>75.7 (8.9)</td>
<td>63.6 (15.1)</td>
<td>&lt; 0.001</td>
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<tr>
<td>SaO₂ &lt; 90%, min‡</td>
<td>3.4 (14.8)</td>
<td>16.5 (55.1)</td>
<td>27.7 (38.3)</td>
<td>121.4 (90.1)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Arousal index‡</td>
<td>15.0 (9.2)</td>
<td>18.3 (12.4)</td>
<td>18.1 (9.9)</td>
<td>31.5 (19.6)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Age, yr‡</td>
<td>42.2 (7.9)</td>
<td>46.3 (9.2)</td>
<td>47.2 (11.2)</td>
<td>46.6 (12.0)</td>
<td>0.004</td>
</tr>
<tr>
<td>Body mass index, kg/m²</td>
<td>24.4 (3.5)</td>
<td>26.9 (4.1)</td>
<td>28.4 (4.6)</td>
<td>29.5 (4.8)</td>
<td>&lt; 0.001</td>
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<tr>
<td>Neck circumference, cm</td>
<td>35.7 (3.4)</td>
<td>37.6 (3.8)</td>
<td>39.3 (3.1)</td>
<td>40.7 (3.7)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Waist circumference, cm</td>
<td>83.3 (10.1)</td>
<td>89.6 (10.1)</td>
<td>95.2 (9.6)</td>
<td>99.5 (11.9)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Hip circumference, cm‡</td>
<td>96.5 (7.0)</td>
<td>99.8 (8.1)</td>
<td>101.6 (7.9)</td>
<td>105.6 (9.4)</td>
<td>&lt; 0.001</td>
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<td>Waist/hip ratio</td>
<td>0.86 (0.07)</td>
<td>0.90 (0.06)</td>
<td>0.94 (0.06)</td>
<td>0.94 (0.07)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Glucose, mmol/L</td>
<td>5.3 (1.4)</td>
<td>5.3 (0.8)</td>
<td>5.4 (0.7)</td>
<td>5.6 (0.7)</td>
<td>0.166</td>
</tr>
<tr>
<td>Insulin, μU/ml‡</td>
<td>6.8 (4.2)</td>
<td>9.0 (12.7)</td>
<td>9.1 (6.7)</td>
<td>15.6 (34.3)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>HOMA-IR‡</td>
<td>1.6 (1.1)</td>
<td>2.2 (3.1)</td>
<td>2.3 (2.0)</td>
<td>4.0 (8.4)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Systolic BP, mm Hg</td>
<td>123.1 (13.9)</td>
<td>127.4 (17.5)</td>
<td>127.3 (13.5)</td>
<td>130.8 (14.0)</td>
<td>0.023</td>
</tr>
<tr>
<td>Diastolic BP, mm Hg</td>
<td>70.6 (10.8)</td>
<td>74.8 (14.3)</td>
<td>78.8 (13.3)</td>
<td>78.8 (12.1)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>
Intermittent hypoxia causes insulin resistance in lean mice

Iyiori et al. Am J Respir Crit Care Med 2007; 175:851-857

![Graph showing blood glucose and glucose infusion rate over time with intermittent hypoxia and intermittent air conditions.](image)
## Does CPAP treatment affect insulin resistance?

<table>
<thead>
<tr>
<th>Study</th>
<th>Follow-up</th>
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<tbody>
<tr>
<td><strong>Negative studies</strong></td>
<td></td>
<td><strong>Positive studies</strong></td>
<td></td>
</tr>
<tr>
<td>Davies et al, 1994</td>
<td>4 mo</td>
<td>Brooks et al, 1994</td>
<td>4 mo</td>
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<tr>
<td>Saarelainen et al, 1997</td>
<td>3 mo</td>
<td>Harsch et al, 2004</td>
<td>3 mo</td>
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<tr>
<td>Coughlin et al, 2007*</td>
<td>6 wk</td>
<td>Babu et al, 2005</td>
<td>3 mo</td>
</tr>
<tr>
<td>West et al, 2007*</td>
<td>3 mo</td>
<td>Dorkova et al, 2008</td>
<td>8 wk (compliant pts)</td>
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<tr>
<td>Trenell et al, 2007</td>
<td>12 wk</td>
<td>Barceló et al, 2008</td>
<td>3 mo (pts with EDS)</td>
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<tr>
<td>Teramoto et al, 2008</td>
<td>6 wk</td>
<td>Schahin et al, 2008</td>
<td>2.9 yr</td>
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<tr>
<td>Comondore et al, 2008*</td>
<td>4 wk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vgontzas et al, 2008</td>
<td>3 mo</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Randomized controlled trial
Stroke

OSA significantly increases the risk of stroke and the increase is independent of other risk factors, including hypertension

– H Klar Yaggi et al NEJM 2005;353:2034-2041
Metabolic Syndrome: Diagnostic Criteria
(NCEP, 3rd Report)

Diagnosis based on any 3 of the following 5 criteria:

- ↑ waist circumference (≥102cm in men, ≥88cm in women)
- ↑ Triglycerides (≥150 mg/dL or drug treatment)
- ↓ HDL-C (<40 mg/dL in men, <50 mg/dL in women, or drug treatment)
- ↑ BP (systolic BP ≥130 mmHg, or diastolic BP ≥ 85 mmHg, or drug treatment for hypertension)
- ↑ Fasting glucose (≥100 mg/dL or drug treatment)
Prevalence of Metabolic Syndrome in OSAS patients from different countries

- Kono 2007, Japan: 19% (non-obese patients)
- Shiina 2006, Japan: 43%
- Sasanabe 2006, Japan: 50%
- Peled 2007, Israel: 63%
- Gruber 2006, UK: 74%
- Lam 2005, Hong Kong: 58%
- Coughlin 2004, UK: 60%
- Parish 2007, USA: 60%
- Palermo-IBIM: 37%

Prevalence of MetS in OSAS
Driving with OSA
In USA 13% of deaths from RTA are caused by the driver falling asleep

In UK 20-25% of the RTA on motorways are due to this
Screen all commercial drivers for obstructive sleep apnoea
Call for lorry drivers to have sleep disorder tests

BBC 2011
Driving

Need to know the difference between OSA and OSAS

Does the driver have symptoms during driving?
• **Group 1 licence holders (car/motorcycle)** diagnosed with sleep apnoea must stop driving until the symptoms have been controlled and confirmed by medical opinion.

• **Group 2 licence holders (LGV)** diagnosed with sleep apnoea must stop driving until the symptoms have been controlled, and must have ongoing treatment. Licensing reviews will be carried out regularly, usually annually.
Driver

It is the driver’s responsibility to ensure their fitness to drive

Driver is legally obliged to tell the DVLA and stop driving
Doctor

When assessing and making decisions

Think about the impact on patient’s life- Job, financial and social aspects.

Think about the impact of accident- fatalities, lifelong disability and emotional distress to patient, family and public.
Doctor should clearly document in the notes the discussion with patient.

If the specialist becomes aware that patient is driving, DVLA can be informed after informing the patient in writing.

GMC recognises you are not legally obliged to do this.
Treatment
Snoring
Anti-Snore pillow

- Euro soft, removable quilted cover
- Adjustable anti-snore air posture support
- Curved to fit neck
- Easy inflate valve
Oral appliance

Mandibular advancement therapy

Tongue stabilising device
Uvulopalatopharyngoplasty (UPPP)
Continuous positive airway pressure (CPAP) is recommended as a treatment option for adults with moderate or severe symptomatic obstructive sleep apnoea/hypopnoea syndrome (OSAHS).

NICE March 2008
Continuous Positive Airway Pressure

CPAP
"Why didn't I think of this before?"
Now that he's getting more sleep—does it give him enough energy to make me breakfast in bed?
Patient referral to sleep service
Sources of referral

GPs

ENT department
Neurologist
Cardiologist
Anaesthetist
Diabetologist
Psychiatrist
Need to reduce consultant to consultant referrals
Who should be referred to L&D Sleep Clinic?

Anyone with a good history and significant day time symptoms

ESS >9

But consider other causes of sleepiness
“I never get a good night’s sleep. Thank God for these office meetings!”
Pathophysiology of CSR/CSA
Untreated Cheyne-Stokes-Respiration (CSR)
Obstructive sleep apnea with loud snoring