Introduction to Sleep Disordered Breathing 2020
Objectives

- Obstructive Sleep Apnea

  - List the symptoms and associated comorbid conditions seen with OSA.
  
  - Define the polygraphic patterns associated with obstructive sleep disordered breathing.

  - Describe the major treatments used for OSA.
Central Sleep Apnea

- Define and identify central sleep apnea.
- Describe the differences between obstructive and central sleep apnea.
- List some treatment options.
Normal Breathing
• Normal Breathing

Oximetry

Heart Rate

Nasal Airflow

Effort

← 30 sec epoch →
What is Sleep Disordered Breathing?

- Is used to describe a group of disorders characterized by abnormalities of the respiratory pattern or ventilation during sleep.
What is Sleep Apnea?

• Defined as a cessation of airflow for a minimum of 10 seconds.
Hypopnea
Categories of Sleep Apnea

A. Obstructive Events

B. Central Events

C. Mixed Events
## Apnea Patterns

<table>
<thead>
<tr>
<th>Flow</th>
<th>Obstructive</th>
<th>Mixed</th>
<th>Central</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Obstructive Flow" /></td>
<td><img src="image2" alt="Mixed Flow" /></td>
<td><img src="image3" alt="Central Flow" /></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effort</th>
<th>Obstructive</th>
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<tr>
<td></td>
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</tbody>
</table>
Is it familiar?
A. What is OSA?

• Criteria A & B
• Or Criteria C

(ICSD), 3rd ed. 2014
A.) What is OSA?

A. The presence of one or more of the following:

1. The patient complains of sleepiness, nonrestorative sleep, fatigue, or insomnia symptoms.
2. The patient wakes with breath holding, gasping, or choking.
3. The bed partner or other observer reports habitual snoring, breathing interruptions, or both during the patient’s sleep.
4. The patient has been diagnosed with hypertension, a mood disorder, cognitive dysfunction, coronary artery disease, stroke, congestive heart failure, atrial fibrillation, or type 2 diabetes mellitus.

(ICSD), 3rd ed. 2014
B. Polysomnography (PSG) or OCST\(^1\) demonstrates:

1. > 5 predominantly obstructive respiratory events (obstructive and mixed apneas, hypopneas, or respiratory effort related arousals [RERAs]) per hour of sleep during a PSG or per hour of monitoring (OCST).

(ICSD), 3rd ed. 2014
A.) What is OSA?

C. PSG or OCST demonstrates:

1. \( \geq 15 \) events predominantly obstructive respiratory events (apneas, hypopneas, or RERAs)\(^3\) per hour of sleep during a PSG or per hour of monitoring (OCST).

(ICSD), 3rd ed. 2014
# OSA Severity Criteria

<table>
<thead>
<tr>
<th>Level</th>
<th>AHI /hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Mild</td>
<td>5 - ≤15</td>
</tr>
<tr>
<td>Moderate</td>
<td>15 - 30</td>
</tr>
<tr>
<td>Severe</td>
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*Sleep.* 1999 Aug 1;22(5):667-89.

Sleep-related breathing disorders in adults: recommendations for syndrome definition and measurement techniques in clinical research. The Report of an AASMA Task Force
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Clinical Features of OSA

1. Nocturnal Symptoms

- Snoring
- 40% of men, 20% of women report habitual snoring
- Associated with considerable social and marital hazard
# Prevalence of Sleep Apnea

<table>
<thead>
<tr>
<th>Study</th>
<th>Men</th>
<th>Women</th>
<th>AHI &gt; 15</th>
<th>EDS</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young</td>
<td>4%</td>
<td>2%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>9%</td>
<td>5%</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>N = 802</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kripke</td>
<td>5%</td>
<td>1.2%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>9%</td>
<td>5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N = 355</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olson</td>
<td>5%</td>
<td>1.2%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>9%</td>
<td>5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N = 2,202</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bearpark</td>
<td>10%</td>
<td>7%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>5%</td>
<td>10%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N = 400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
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**USA**

- **Kripke**
  - Men: 9% (AHI > 15)
  - Women: 5% (AHI > 15)
  - N = 355

- **Olson**
  - Men: 5% (AHI > 15)
  - Women: 1.2% (AHI > 15)
  - N = 2,202

- **Bearpark**
  - Men: 10% (AHI > 10)
  - Women: 7% (AHI > 10)
  - N = 400

**Australia**

- **Kripke**
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  - Women: 1.2% (AHI > 15)
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  - N = 400

**EDS**

- Age 36-60
## Prevalence in a Saudi Sample

<table>
<thead>
<tr>
<th></th>
<th>Middle-aged Saudi Men (n=578)</th>
<th>Middle-aged Saudi Women (n=400)</th>
<th>Netzer et al(^1) (n=744)</th>
<th>Heistand et al(^2) (n=1506)</th>
<th>Sharma et al(^3) (n=180)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age</td>
<td>44.6 ± 9.8</td>
<td>43.74 — 6.31</td>
<td>48.9 ± 17.5</td>
<td>49</td>
<td>--</td>
</tr>
<tr>
<td>Snoring</td>
<td>52.3%</td>
<td>40.8</td>
<td>52.2%</td>
<td>59.0%</td>
<td>--</td>
</tr>
<tr>
<td>Day time fatigue &gt;3 time a week</td>
<td>19.3%</td>
<td>9.5%</td>
<td>38.8%</td>
<td>26.0%</td>
<td>--</td>
</tr>
<tr>
<td>Drowsy driving</td>
<td>29.6%</td>
<td>19.9%</td>
<td>32.0%</td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>HTN (known)</td>
<td>18.0%</td>
<td>24.0%</td>
<td>26.0%</td>
<td>29.0%</td>
<td>53%</td>
</tr>
<tr>
<td>High risk</td>
<td>32.8%</td>
<td>39.0</td>
<td>37%</td>
<td>Males 31% Females 21%</td>
<td>44.4%</td>
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<td><strong>Females 21%</strong> 44.4%</td>
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<tr>
<th>Study</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wali et al, Saudi Arabia</td>
<td>Men: 11.2%</td>
</tr>
<tr>
<td></td>
<td>Women: 4%</td>
</tr>
</tbody>
</table>
Otherwise snore and this will happen to you....

Or sleep alone....

www.corbett.com.au
2. Daytime Sleepiness

- Differential diagnosis includes:
  - Insufficient Sleep
  - Medical and psychological disorders
  - Medications
Clinical Features of OSA

• Nocturnal Choking / Gasping
  – Bed partners may recognize this more commonly than the patient.

Screening Daytime Sleepiness

The University Sleep Disorders Center
King Khalid University Hospital

Epworth Sleepiness Scale

0 = would less than once a month doze
1 = slight chance of dozing
2 = moderate chance of dozing
3 = high chance of dozing

<table>
<thead>
<tr>
<th>Situation</th>
<th>Chance of Dozing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting and Reading</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Watching TV</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Sitting inactive in a public place (in awaiting area or in a meeting)</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>As passenger in a car for an hour without a break</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Lying down to rest in the afternoon when circumstances permit</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Sitting and talking to someone</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Sitting quietly after a lunch</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>In a car, while stopped for a few minutes in the traffic</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Total score</td>
<td></td>
</tr>
<tr>
<td>How long have you been like this (months/year)</td>
<td></td>
</tr>
</tbody>
</table>
**Epworth Sleepiness Scale**

<table>
<thead>
<tr>
<th>situation</th>
<th>score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving</td>
<td>3</td>
</tr>
<tr>
<td>Watching TV</td>
<td>2</td>
</tr>
<tr>
<td>Reading</td>
<td>1</td>
</tr>
<tr>
<td>Sitting with someone talking</td>
<td>3</td>
</tr>
<tr>
<td>Sitting alone with eyes closed</td>
<td>2</td>
</tr>
<tr>
<td>Sitting at a desk</td>
<td>1</td>
</tr>
</tbody>
</table>

**Scoring Key:**
- 0: Almost never
- 1: Rarely
- 2: Sometimes
- 3: Often

**Summary:**
- Total score: 0-10
- Scores of 10 or higher indicate a high risk of sleep-related driving problems.
# Stanford Sleepiness Scale (SSS)

**The Stanford Sleepiness Scale**

Please record the scale value that best describes your state of sleepiness:

1. Feeling active and vital; alert; wide awake
2. Functioning at a high level, but not at peak; able to concentrate
3. Relaxed; awake; not at full alertness; responsive
4. A little foggy; not at peak; let down
5. Fogginess; beginning to lose interest in remaining awake; slowed down
6. Sleepiness; prefer to be lying down; fighting sleep; woozy
7. Almost in reverie; sleep onset soon; lost struggle to remain awake

SSS scores range from 1 to 7, with increasing scores indicating increased sleepiness.

### STOP Bang Questionnaire

#### Personal Profile

<table>
<thead>
<tr>
<th>No.</th>
<th>PSG S No.</th>
<th>Nationality</th>
<th>□ Saudi</th>
<th>□ Non Saudi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age (Years):</th>
<th>Height (cm):</th>
<th>Weight (Kgs):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Neck Size (cm):</th>
<th>Occupation:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Marital Status:</th>
<th>□ Single</th>
<th>□ Married</th>
<th>□ Divorced</th>
<th>AHI:</th>
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<table>
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<th>Hospital Name:</th>
<th>City:</th>
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</tbody>
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**PLEASE ANSWER THE FOLLOWING QUESTIONS AS ACCURATELY AS POSSIBLE. WHERE APPLICABLE, PLACE A CHECK MARK (✓) NEXT TO THE BEST ANSWER:**

#### Snoring?
Do you **Snore Loudly** (louder than talking or loud enough to be heard through closed doors)?
- [ ] Yes
- [x] No

#### Tired?
Do you often feel **Tired, Fatigued, or Sleepy** during the daytime?
- [ ] Yes
- [x] No

#### Observed?
Has anyone observed you **Stop Breathing** during your sleep?
- [ ] Yes
- [x] No

#### Pressure?
Do you have or are being treated for **High Blood Pressure**?
- [ ] Yes
- [x] No

#### Body Mass Index
BMI is more than 35?
- [ ] Yes
- [x] No

#### Age
Age older than 50?
- [ ] Yes
- [x] No

#### Neck size large?
Do you have a **Neck that Measures** more than 16 inches / 40 cm around (measure at Adam's Apple)?
- [ ] Yes
- [x] No

#### Gender
Male?
- [ ] Yes
- [x] No
المركز الجامعي للطب وأبحاث النوم  
كلية الطب - جامعة الملك سعود

**استبيان STOPBang**

**البيانات الشخصية**

<table>
<thead>
<tr>
<th>المادة</th>
<th>منتظر</th>
<th>موافق</th>
<th>غير موافق</th>
</tr>
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<tbody>
<tr>
<td>الجنس</td>
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<td></td>
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<tr>
<td>العمر</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>القيادة</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>الوضع الاعتقالي</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>الوضع الاجتماعي</td>
<td></td>
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</tr>
<tr>
<td>نموذج</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>اسم المستقل</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**الجواب الإجابة على الأسئلة أدناه تعتمد ما إذا كانت معرّضة لإحتمال توقف التنفس أثناء النوم ، الرجاء الإجابة بدقة قبل الإمكان بروح علاجية لا يجاب الإجابة**

<table>
<thead>
<tr>
<th>السؤال</th>
<th>رقم</th>
<th>0</th>
<th>1</th>
<th>2</th>
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</thead>
<tbody>
<tr>
<td>ماذا تشعر بصوت العاالي (أعلى من صوت المكالمات) بشكل عام؟ أو أن شخيرك على مدار ночاتك يثير من وزن الأอบوب مختلفة؟</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>ماذا تشعر بلاي (أعلى من صوت المكالمات) بشكل عام؟ أو أن شخيرك على مدار لياليك يثير من وزن الأوبوب مختلفة؟</td>
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<td>2</td>
</tr>
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**الإجابة = 20**
BERLIN QUESTIONNAIRE

Height (m) ______ Weight (kg) ______ Age ______ Male / Female
Please choose the correct response to each question.

CATEGORY 1
1. Do you snore?
   _ a. Yes
   _ b. No
   _ c. Don’t know

If you snore:
2. Your snoring is:
   _ a. Slightly louder than breathing
   _ b. As loud as talking
   _ c. Louder than talking
   _ d. Very loud – can be heard in adjacent rooms

3. How often do you snore
   _ a. Nearly every day
   _ b. 3-4 times a week
   _ c. 1-2 times a week
   _ d. 1-2 times a month
   _ e. Never or nearly never

4. Has your snoring ever bothered other people?
   _ a. Yes
   _ b. No
   _ c. Don’t Know

5. Has anyone noticed that you quit breathing during your sleep?
   _ a. Nearly every day
   _ b. 3-4 times a week
   _ c. 1-2 times a week
   _ d. 1-2 times a month
   _ e. Never or nearly never

CATEGORY 2
6. How often do you feel tired or fatigued after your sleep?
   _ a. Nearly every day
   _ b. 3-4 times a week
   _ c. 1-2 times a week
   _ d. 1-2 times a month
   _ e. Never or nearly never

7. During your waking time, do you feel tired, fatigued or not up to par?
   _ a. Nearly every day
   _ b. 3-4 times a week
   _ c. 1-2 times a week
   _ d. 1-2 times a month
   _ e. Never or nearly never

8. Have you ever nodded off or fallen asleep while driving a vehicle?
   _ a. Yes
   _ b. No

If yes:
9. How often does this occur?
   _ a. Nearly every day
   _ b. 3-4 times a week
   _ c. 1-2 times a week
   _ d. 1-2 times a month
   _ e. Never or nearly never

CATEGORY 3
10. Do you have high blood pressure?
    _ Yes
    _ No
    _ Don’t know
استبانة برلين

الاسم: ____________________________
العمر: ____________________________
الوزن (كilogرام): ________________
 dysfunctional (طويل) ________________

الرحلة الخاصة الرد الصحيح لكل سؤال فيما يلي:

السؤال الأول:
1. هل تشعر؟
   a) نعم
   b) لا
   c) نعم
   d) لا يهم

السؤال الثاني:
2. كيف يمكن أن تحدث صوت متحرك?
   a) أخذت عنصر من صوت الأضواء
   b) شربت من التعب
   c) أخذت عنصر من التعب
   d) لم يحدث

3. كم مرة يتحرك متحرك؟
   a) كل يوم تزمر
   b) كل يوم تزمر
   c) 4 إلى 12 مرة باليوم
   d) لا يحدث

4. هل يمكن أن يكون هبوب الأذن، كلاً?
   a) نعم
   b) لا
   c) نعم
   d) لا

5. هل تحس أن شخص آخر طرف أثناء النوم؟
   a) نعم
   b) 4 إلى 12 مرة باليوم
   c) 4 إلى 12 مرة باليوم
   d) لا يحدث

6. كم مرة تشعر بالضيق أو الإرهاب عند الخروج من النوم?
   a) نعم
   b) 4 إلى 12 مرة باليوم
   c) 4 إلى 12 مرة باليوم
   d) لا يحدث

7. هل تحس بأذن أو الإرهاب أثناء النوم؟
   a) نعم
   b) 4 إلى 12 مرة باليوم
   c) 4 إلى 12 مرة باليوم
   d) لا يحدث
8. هل تستخدم أقراص لعلاج القلق أو الانعكاسات النفسية؟
- نعم
- لا
- لا أعرف

إذا كانت الإجابة نعم:
9. كم مرة يحدث هذا:
- كل يوم
- أحيانا
- أقل من مرة في الأسبوع
- مرة في مرة واحدة
- مرة أو أكثر من ذلك
- لا أعرف

الجواب: لا أعرف

القسم الثالث:
10. هل كنت مصابًا بارتفاع ضغط الدم؟
- نعم
- لا
- لا أعرف
WHAT ARE THE RISK FACTORS?
Risk Factors of OSA

1. Structural Abnormalities:
   - Short Fat Neck
     (Neck circumference >17”/16”)
Risk Factors of OSA

- Small Mandible

Retrognathia

Risk Factors of OSA
Overbite
Risk Factors of OSA

2. Upper airway narrowing:
   - Large tonsils / adenoids
Cont..
(Upper airway narrowing)

- Long uvula
Large tongue

Non-Obstructed Airway

Obstructed Airway

Science-based Medicine [https://sciencebasedmedicine.org/dental-management-of-obstructive-sleep-apnea/]
Cont..
(Upper airway narrowing)
Mallampati Score to Help Predict Obstructive Sleep Apnea
Levels of airway obstruction
3. Obesity

- Strongest risk factor for OSA.

- Present in >60% of patients referred for a diagnostic sleep evaluation.
Twenty Years of Increasing Obesity

% Obesity

1960: 13.4%
1974: 14.5%
1980: 15%
1994: 22.9%
2000: 30.5%

PREVALENCE OF OBESITY IN SAUDI ARABIA

% of Subjects

Male   Female   Overall

(BMI ≥ 30 kg/m²)

Al-Nozha et al. SMJ 2005;26:824-829
Patient Evaluation

Normal Airway

Obstructed Airway

Sleep Disorders & Sleep Apnea with Dr. Kushner, DDS
http://www.brownkushner.com/Sleep Apnea.pdf
Sagittal Upper Airway MRI Images

Normal

Apneic

(Schwab et al, Am J Respir Crit Care Med 152:1673, 1995)
OSA and Medical Comorbidity

Obstructive Sleep Apnea

- Cardiac problems, Abnormal heart rhythms, heart attack and heart failure
- High Blood Pressure
- Increased Insulin resistance (event in non diabetic patients)
- Increased traffic and workplace accidents
- Stroke
- Memory problems and inability to think

Cardiac problems, Abnormal heart rhythms, heart attack and heart failure

High Blood Pressure

Increased Insulin resistance (event in non diabetic patients)

Increased traffic and workplace accidents

Stroke

Memory problems and inability to think
Representative Signals

OSA

Oximetry
Heart Rate
Nasal Airflow
Effort
General Measures

These measures should be tried in all patients with OSDB:

• Weight loss
• Avoidance of alcohol & sedatives
• Sleep position
• Driving and operation of heavy machinery
• Weight loss is like getting into heaven….. It is SIMPLE but it is not EASY.
Positional Therapy

• Try sleeping on the side.

Wake up and put your tennis-ball t-shirt on so you can stay on your side and I can rest.
Sleep Position Training
Specific Measures

- Continuous Positive Airway Pressure (CPAP)
- Intra – Oral Appliances
- Surgical Treatment
- Hypoglossal Nerve Stimulation
Continuous Positive Airway Pressure (CPAP)

- Is the gold standard treatment
Continuous Positive Airway Pressure

Before

After
Benefits of CPAP

• Improves quality of life even in mild OSA
• Improves bed partner sleep
• Improves daytime sleepiness
• Decreases motor vehicle accident
• Improves hypertension
• Increases ejection fraction in systolic CHF
• Improves insulin resistance
• Decreases inflammatory markers
  • CRP (C-reactive protein)
See 1 citation found by title matching your search:


BaHammam AS, Alassiri SS, Al-Adab AH, Alsadhan IM, Altheyab AM, Alrayes AH, Alkhawajah MM, Olaish AH.

Abstract

OBJECTIVES: To evaluate continuous positive airway pressure (CPAP) compliance and define predictors of CPAP compliance among Saudi patients with obstructive sleep apnea (OSA) after applying an educational program.

METHODS: This prospective cohort study included consecutive patients diagnosed to have OSA based on polysomnography between January 2012 and January 2014 in King Saud University, Riyadh, Kingdom of Saudi Arabia. All patients had educational sessions on OSA and CPAP therapy before sleep study, and formal hands-on training on CPAP machines on day one, day 7, and day 14 after diagnosis. The follow-up in the clinic was carried out at one, 4, and 10 months after initiating CPAP therapy. Continuous positive airway pressure compliance was assessed objectively. Logistic regression model was used to assess the predictors of CPAP adherence.

RESULTS: The study comprised 156 patients with a mean age of 51.9±12.1 years, body mass index of 38.4±10.6 kg/m², and apnea hypopnea index of 63.7±39.3 events/hour. All patients were using CPAP at month one, 89.7% at month 4, and 83% at month 10. The persistence of CPAP-related side effects and comorbid bronchal asthma remained as independent predictors of CPAP compliance at the end of the study.

CONCLUSION: With intensive education, support, and close monitoring, more than 80% of Saudi patients with OSA continued to use CPAP after 10 months of initiating CPAP therapy.

Figure 1-A: CPAP compliance at 1, 4 and 10 months
Conclusions

- Nasal CPAP is the treatment of choice
- Successful treatment in 95% of patients
- Not as costly as surgery
- Long term compliance 60-70%
- Improve long term survival
- Can re-titrate the pressure if the patient’s clinical condition changes
Mandibular Advancement Device

Oral Appliance Pulls the Lower Jaw Forward, Opening the Airway
Maxillomandibular advancement
Hypoglossal nerve stimulation
B.) Obesity Hypoventilation Syndrome

- Is defined by extreme obesity and alveolar hypoventilation during wakefulness.
  - Obesity
  - $\text{PaCO}_2 > 45$
  - $\text{PaO}_2 < 70$
  - Absence of significant pulmonary disease
Criteria A-C must be met

A. Presence of hypoventilation during wakefulness ($\text{PaCO}_2 > 45 \text{ mm Hg}$) as measured by arterial $\text{PCO}_2$, end-tidal $\text{PCO}_2$, or transcutaneous $\text{PCO}_2$.

B. Presence of obesity ($\text{BMI} > 30 \text{ kg/m}^2$; > 95th percentile for age and sex for children).

C. Hypoventilation is not primarily due to
   - lung diseases,
   - medication use,
   - neurologic disorder,
   - muscle weakness,
   - or a known congenital or idiopathic central alveolar hypoventilation syndrome.

(ICS), 3rd ed. 2014
Clinical Features of OHS

1. Extreme Obesity
2. Middle-aged

3. Significant sleep-disordered breathing (fatigue, hypersomnolence, snoring, morning headache)

4. Prone to develop severe pulmonary hypertension
Increased work of breathing and increased needs to augment minute ventilation to maintain adequate alveolar ventilation

Patient can increase ventilatory drive and minute ventilation

Patient cannot increase ventilatory drive and minute ventilation

Normal ventilation and eucapnia

Hypoventilation especially during sleep hypercapnia and hypoxemia

Simple obesity

OSA

OHS + OSA

OHS

10%

90%

AlDabal & BaHammam. ATM 2010
Prevalence, clinical characteristics, and predictors of obesity hypoventilation syndrome in a large sample of Saudi patients with obstructive sleep apnea

Ahmed S. BaHammam, FRCP, FCCP
• Out of 1693 OSA patients, OHS was identified in 144 (8.5%) (women 66.7%).

Saudi Med J 2015; Vol. 36 (2)
## Prevalence of OHS in OSA

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_BaHammam AS. SMJ 2015; 36(2):181-9_
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*BaHammam AS. SMJ 2015; 36(2):181-9*
Patient with OHS
C.) Central Sleep Apnea

- Is a disorder of decreased breathing rate or depth, particularly during sleep due to a transient reduction or withdrawal of central output to the respiratory muscles (the diaphragm and intercostal muscles).
Central Apnea

- Absent inspiratory effort throughout the entire period of absent airflow.

Nasal / Oral Airflow

Respiratory Effort - chest

Respiratory Effort - abdomen
Central Apnea
Central Apnea
Diagnostic Criteria
(A or B) + C + D satisfy the criteria

A. The presence of one or more of symptoms

B. The presence of
   – atrial fibrillation/flutter,
   – congestive heart failure,
   – or a neurological disorder.

(ICSD), 3rd ed. 2014
C. PSG shows all of the following:

1. $\geq 5$ central apneas and/or central hypopneas per hour of sleep.

2. The total number of central apneas and/or central hypopneas is $> 50\%$ of the total number of apneas and hypopneas.

3. The pattern of ventilation meets criteria for Cheyne-Stokes breathing (CSB).

(ICSD), 3rd ed. 2014
Cheyne Stokes Respiration (Periodic Breathing)

- A breathing pattern characterized by regular “crescendo-decrescendo” fluctuations in respiratory rate and tidal volume.
- More common among patients with heart failure and low ejection fraction.
- Associated with poor prognosis in patients with heart failure.
Representative Signal

CSA - CSR

Oximetry

Heart Rate

Nasal Airflow

Effort
D.) Mixed Apnea

- Begins as central apnea followed by obstructive apnea
- Seen in patients with OSA
- Often found in Down’s Syndrome
Mixed Apnea

- Absent inspiratory effort in the initial portion of the event, followed by resumption of inspiratory effort in the second portion of the event.
Mixed Apnea
Sleep Disordered Breathing is an important medical disorder that warrants active investigation by means of a clinical evaluation and polysomnographic sleep studies.

Treatment is essential, not only to improve the symptoms that include sleepiness, but also to prevent the development of cardiovascular complications.

Effective treatments exist that include behavioral, medical and surgical means; dramatic improvements in patient’s well being can be achieved.
• A breathing pattern characterized by regular “crescendo-decrescendo” fluctuations in respiratory rate and tidal volume.

a. Obstructive Apnea
b. Hypopnea
c. Cheyne Stokes Respiration
d. OHS (Obesity Hypoventilation Syndrome)
Thank You