How, what, and why of sleep apnea

Perspectives for primary care physicians

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ABSTRACT

OBJECTIVE  To review the need for primary care physicians to screen for patients with obstructive sleep apnea (OSA).

QUALITY OF EVIDENCE  Literature was reviewed via MEDLINE from 1993 to 2000, inclusive, using the search term “sleep apnea” combined with “epidemiology,” “outcome,” and “diagnosis and treatment.” Citations in this review favour more recent, well controlled and randomized studies, but findings of pilot studies are included where other research is unavailable.

MAIN MESSAGE  Obstructive sleep apnea is a disorder with serious medical, socioeconomic, and psychological morbidity, yet most patients with OSA remain undetected. Primary care physicians have a vital role in screening for these patients because diagnosis can be made only through overnight (polysomnographic) studies at sleep clinics. Physicians should consider symptoms of excessive or loud snoring, complaints of daytime sleepiness or fatigue, complaints of unrefreshing sleep, and an excess of weight or body fat distribution in the neck or upper chest area as possible indications of untreated OSA.

CONCLUSION  Current research findings indicate that treating OSA patients substantially lowers morbidity and mortality rates and reduces health care costs. Primary care physicians need more information about screening for patients with OSA to ensure proper diagnosis and treatment of those with the condition.

RÉSUMÉ

OBJECTIF  Passer en revue la nécessité pour les médecins de famille de dépister chez les patients l’apnée obstructive du sommeil (AOS).

QUALITÉ DES DONNÉES  Une recension des ouvrages scientifiques a été effectuée dans MEDLINE de 1993 à 2000 inclusivement à l’aide des termes de recherche en anglais pour « apnée du sommeil » combinés avec «épidémiologie », « issue » et « diagnostic et traitement ». Les citations dans la présente étude privilégient les études aléatoires et bien contrôlées plus récentes mais les conclusions d’études expérimentales sont incluses lorsque d’autres recherches n’étaient pas disponibles.

PRINCIPAL MESSAGE  L’apnée obstructive du sommeil est un trouble comportant une sérieuse morbidité médicale, socio-économique et psychologique et pourtant, la majorité des patients qui en souffrent demeurent non dépistés. Les médecins de première ligne exercent un rôle essentiel dans le dépistage de ces patients parce que le diagnostic ne peut être effectué que par des évaluations (polysomnographiques) durant la nuit dans des cliniques du sommeil. Les médecins devraient considérer les symptômes de ronflement excessif ou bruyant, les plaintes de somnolence ou de fatigue durant la journée, les plaintes de sommeil non réparateur et un excès de poids ou de répartition du gras corporel dans la région du cou ou du thorax supérieur comme des indices possibles d’une AOS non traitée.

CONCLUSION  Les conclusions des recherches actuelles signalent que le traitement des patients souffrant d’AOS réduit considérablement les taux de morbidity et de mortalité ainsi que les coûts des services de santé. Les médecins de première ligne ont besoin de plus de renseignements concernant le dépistage des patients souffrant d’AOS pour assurer un diagnostic et un traitement appropriés des ceux qui en sont atteints.

This article has been peer reviewed.
Cet article a fait l’objet d’une évaluation externe.
Sleep apnea is defined as cessation of breathing during sleep lasting more than 10 seconds and resulting in total or partial arrest in respiration. Obstruction of the upper airway during respiratory effort is termed obstructive sleep apnea (OSA). Mechanical abnormalities of the upper airway play a vital role in the pathophysiology of OSA. The upper airway is more likely to collapse if the passage is anatomically narrow or the pharyngeal muscles are lax. Pharyngeal dilator muscle reflexes, normally active when people are awake, appear blunted during sleep, predisposing the airways to collapse.

The severity of OSA is sometimes rated on the apnea-hypopnea index (AHI); an AHI rating of > 15 indicates clinically significant OSA. Even patients with mild OSA (<15), however, can experience considerable daytime sleepiness and need treatment.

How common is sleep apnea?
The estimated prevalence of sleep apnea varies with sex and age. Among middle-aged adults, clinically significant OSA affects approximately 2% to 5% of men and 2% of women. About 4% of elderly people present with OSA, and about 29% of those complaining of insomnia are diagnosed with OSA. Sleep apnea is more prevalent and severe in obese people. Others at greater risk of OSA are those with hypertension, congestive heart disease, coronary artery disease, first-ever stroke, gastroesophageal reflux, primary open-angle glaucoma, heart transplants, hypothyroidism, alcoholism, and autonomic neuropathy secondary to diabetes.

Why is it important to identify sleep apnea?
Sleep apnea has been vastly underrecognized in primary practice. Researchers estimate that 82% of men and 93% of women with moderate-to-severe OSA have not been clinically detected or diagnosed. Delay in diagnosis and treatment has led to prolonged morbidity. We hope this review will help physicians understand this sleep disorder and recognize the clinical symptoms of OSA.

The consequences of undiagnosed and untreated OSA are not trivial. The quality of life for patients with untreated OSA is seriously impaired, partly due to their excessive daytime sleepiness. Also, untreated OSA is linked to psychological morbidity, such as cognitive dysfunction, decreased vigilance, disturbed concentration and memory, increased mental stress, depression, fatigue, anxiety, nocturnal panic attacks, general mood disorders, and male sexual dysfunction.

The most serious socioeconomic effect of untreated OSA is the three- to seven-fold greater prevalence of motor vehicle accidents involving drivers with untreated OSA. Most of these accidents are attributable to decreased vigilance and falling asleep at the wheel. A more direct economic consequence is medical and hospitalization costs. A Canadian study reported that patients with untreated OSA generally used twice the amount of health care services in the years before diagnosis than after diagnosis.

A causal relationship has been found between untreated OSA and coronary artery disease, congestive heart failure, myocardial infarction, stroke, systemic hypertension, and pulmonary hypertension. The morbidity and association between hypertension and untreated OSA is well established and is independent of confounding factors (eg, age, sex, body mass index); the association appears stronger among younger patients. The clinical significance of the association between untreated OSA and hypertension is still unclear: untreated OSA might trigger only slight elevations (5 to 10 mm Hg) in diastolic and nocturnal systolic blood pressure. Nevertheless, in patients with untreated OSA, clinically significant systemic or pulmonary hypertension can develop over time, especially when OSA is severe and patients have a greater number of risk factors for hypertension. Physicians should be aware that hypertension associated with untreated OSA is often intractable, and that a high prevalence (56%) of OSA has been observed in men with therapy-resistant hypertension.

The long-term outcome of untreated OSA is a higher mortality rate than that among the general Canadian population. Mean age of death among people with untreated OSA is 59 years.

Quality of evidence
A MEDLINE search was conducted from January 1993 to December 2000 using the search term “sleep apnea” combined with “epidemiology,” “outcome,” and “diagnosis and treatment,” and limited to articles in English. From more than 1700 citations, 928 abstracts were downloaded, and 295 papers were retrieved based on review of those abstracts. The 59 papers we finally selected for this study were chosen for their relevance to the topic, how current they...
were, the quality of the research, the originality and significance of the findings, the scientific contribution of the work, and the accessibility of the paper. Other papers were identified from the reference lists of the papers selected.

Levels of evidence for the epidemiology and treatment content of the studies cited were 5% level II (randomized trials), 42% level III (non-randomized controlled or concurrent cohort studies), 42% level IV (non-randomized historical cohort or observational studies); the remaining 11% were review articles.

**How to detect OSA symptoms**

Snoring is a common complaint, but by itself does not definitely imply presence of OSA. The main symptom of untreated OSA is hypersomnolence or excessive daytime sleepiness that often manifests as dozing off in meetings or while reading, watching television, or driving. Some patients, especially women, describe a lack of energy and tiredness or fatigue rather than sleepiness. These symptoms should be considered clinically significant for OSA. Patients are likely to report unrefreshing and restless sleep at night and occasionally nocturia. Helpful history can be obtained from patients’ bed partners who can observe loud snoring, choking, shortness of breath, or changes in patients’ personalities (eg, increased irritability) (Table 1).

Other symptoms can include morning headaches, frequent nocturnal awakenings, reduced libido, a feeling of drunkenness in the morning, nocturnal gastroesophageal reflux, enuresis, bilateral pedal edema, and night sweats. Table 2 lists some less common symptoms and complaints of those with untreated OSA.

**Table 2. Less common features of obstructive sleep apnea: Listed under each heading in descending order of incidence.**

**NOCTURNAL MANIFESTATIONS**
- Gasping for air
- Shortness of breath
- Chronic mouth breathing
- Frequent awakenings
- Restless sleep (turning, tossing, leg and arm movements)
- Gastroesophageal reflux
- Nocturnal panic attacks
- Excessive sweating
- Nocturnal cyclical bradycardia

**DAYTIME MANIFESTATIONS**
- Lack of energy, tiredness, fatigue
- Daytime naps are not refreshing
- Morning headaches
- Feeling of morning “drunkenness”
- Bilateral leg edema

Risk factors for developing OSA include obesity, snoring, aging, large neck circumference, hypertension, hypothyroidism, diabetes, heavy alcohol consumption, history of smoking, male sex, postmenopausal status, and family history. Patients of different ethnic origins

**Table 1. Common symptoms and complaints of patients with obstructive sleep apnea (OSA):**

<table>
<thead>
<tr>
<th>SYMPTOMS IN ORDER OF IMPORTANCE</th>
<th>COMPLAINTS THAT CORRESPOND WITH SYMPTOMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive daytime sleepiness</td>
<td>“I fall asleep in meetings, at my desk, and even sometimes when I am driving.” “I could fall asleep anywhere, anytime.” “My head barely touches the pillow and I’m asleep.”</td>
</tr>
<tr>
<td>Loud snoring, stopped or shallow breathing, or choking during sleep</td>
<td>“I snore so loudly my partner can’t sleep in the same room.” “My partner says that I choke or stop breathing in my sleep.” “My pillow is often wet in the morning—I seem to drool a lot.”</td>
</tr>
<tr>
<td>Unrefreshing sleep, possibly with nocturia</td>
<td>“My sleep is never refreshing, I never feel rested when I wake up.” “Even if I take a daytime nap, I still don’t feel rested.” “I wake up several times during the night, often to pass urine.”</td>
</tr>
<tr>
<td>Weight gain or more body fat in neck or chest or abdomen*</td>
<td>“I have increased my shirt neck size recently.” “I have gained weight over the past year or so.”</td>
</tr>
<tr>
<td>Irritability, mood changes, and loss of libido. Can mimic depression†</td>
<td>“I have been very irritable, yelling at my kids over small matters.” “I have been very moody.” “I never feel like having sex anymore.”</td>
</tr>
</tbody>
</table>

*Former weight-lifters or athletes with heavy musculature in the neck and upper chest area without any other noticeable weight gain have a higher incidence of OSA.

†Differential diagnosis is crucial because untreated OSA can produce symptoms of depression.
Table 3. Berlin Questionnaire: Level of risk is based on responses in symptom categories. In categories 1 and 2, high risk is characterized by continuing symptoms (more than three or four times a week) in two or more questions on snoring and on sleepiness during waking time or driving, respectively. For category 3, high blood pressure or body mass index ≥ 30 are considered high risk. Patients with high-risk features in any two of the three categories warrant referral to a sleep clinic.

<table>
<thead>
<tr>
<th>Height (m)</th>
<th>Weight (kg)</th>
<th>Age</th>
<th>Male/Female</th>
</tr>
</thead>
</table>

CIRCLE THE ANSWERS BELOW

**CATEGORY 1**

1. Do you snore?
   - [ ] Yes  [ ] No  [ ] Don’t know

If you snore:

2. Your snoring is
   - [ ] Slightly louder than breathing  [ ] As loud as talking  [ ] Louder than talking
   - [ ] Very loud, can be heard in adjacent rooms

3. How often do you snore?
   - [ ] Nearly every day  [ ] Three to four times a week  [ ] Once or twice a week
   - [ ] Once or twice a month  [ ] Never or nearly never

4. Has your snoring ever bothered other people?
   - [ ] Yes  [ ] No

5. Has anyone noticed that you quit breathing during sleep?
   - [ ] Nearly every day  [ ] Three to four times a week  [ ] Once or twice a week
   - [ ] Once or twice a month  [ ] Never or nearly never

**CATEGORY 2**

6. How often do you feel tired or fatigued after your sleep?
   - [ ] Nearly every day  [ ] Three to four times a week  [ ] Once or twice a week
   - [ ] Once or twice a month  [ ] Never or nearly never

7. During your waking time, do you feel tired, fatigued, or not up to par?
   - [ ] Nearly every day  [ ] Three to four times a week  [ ] Once or twice a week
   - [ ] Once or twice a month  [ ] Never or nearly never

8. Have you ever nodded off or fallen asleep while driving a vehicle?
   - [ ] Yes  [ ] No

If yes:

9. How often does this occur?
   - [ ] Nearly every day  [ ] Three to four times a week  [ ] Once or twice a week
   - [ ] Once or twice a month  [ ] Never or nearly never

**CATEGORY 3**

10. Do you have high blood pressure?
    - [ ] Yes  [ ] No  [ ] Don’t know  [ ] Never

Adapted from Table 2 in Netzer et al14 with permission from the American College of Physicians.
can present differently with OSA. For example, Chinese patients tend to be younger and have a lower body mass index than white patients, but they present with more severe underlying craniofacial abnormalities.46

Polysomnography, routinely performed only in sleep disorder centres, is the main established technique for determining the presence and severity of sleep-disordered breathing.15 Diagnosis and treatment of OSA patients at sleep clinics depends on primary physicians’ ability to recognize the disorder and make the appropriate referral. Because it is not feasible to send every patient who snores for evaluation, primary physicians should conduct careful interviews, physical examinations, and screening for other medical disorders.

For most physicians, the symptoms listed in Table 1 give a good indication of whether to refer patients for further investigation. For those who prefer a more structured approach, Table 3 presents an adaptation of the Berlin Questionnaire that was designed specifically to assist primary care physicians in recognizing OSA. Patients who report snoring often and loudly and who suffer from excessive daytime sleepiness in association with hypertension are at very high risk of OSA. The questionnaire takes about 5 minutes to complete, and for patients with clinically significant OSA (AHI >15), the positive predictive value is 0.97, the specificity 0.97, and the sensitivity 0.54.

Another questionnaire commonly used for screening for OSA, the Epworth Sleepiness Scale,49 examines excessive daytime sleepiness, a key feature of OSA. The eight items of the Epworth Sleepiness Scale measure propensity for daytime sleep in adults with an internal consistency (Cronbach’s α) of 0.88, and at a cutoff score of >10, this measure has a 94% sensitivity and 100% specificity. While this questionnaire is not specifically diagnostic for OSA, it is a useful indicator of general sleep disorders. Apart from these two inventories, no other questionnaires are specific and exclusive for OSA and useful in primary clinical settings. Physicians should note that neither of the above questionnaires is intended to replace a medical interview; they are examples of screening tools that can be completed by patients in the waiting room to assist physicians with diagnosis of OSA.

It is important to emphasize that primary physicians should assess their patients’ medical status thoroughly before referring them for a sleep study. The following laboratory investigations could be specifically helpful in assessment, diagnosis, and management of OSA and its complications.

- Complete blood count: elevated hemoglobin or hematocrit levels suggest chronic hypoxia.
- Electrocardiogram (ECG): abnormalities of cardiac rhythm (first- or second-degree heart block) are common in severe OSA.
- Electrolytes: electrolytes, particularly serum potassium levels, are important when evaluating ECG disturbances.
- Blood glucose and serum thyroid-stimulating hormone levels: diabetes and glucose intolerance are clearly associated with OSA. Hypothyroidism is a cause of upper airway obstruction and OSA, and is easily treated.

### Treatment

Treatment options for OSA patients include modification of body position during sleep,48 weight loss,50 continuous positive airway pressure (CPAP), oxygen supplementation,51 oral appliances,52 and surgery.53 Preliminary reports of using serotonin reuptake inhibitors (SSRIs) and tricyclic antidepressants (TCAs) to treat OSA are promising; it has been proposed that serotonin is a central respiratory stimulant. In some patients, OSA is more severe and frequent during rapid eye movement (REM) sleep, and suppression of REM sleep by SSRIs and TCAs might, in large part, explain their beneficial effects. Other pharmacologic treatments appear ineffective.55

Adjunctive management of OSA should include moderating alcohol consumption and avoiding sedatives-hypnotics and narcotics because these are respiratory depressants and might worsen breathing disorders. Table 4 summarizes the advantages and disadvantages of the various treatments for OSA.

Nasal CPAP, the most common treatment, is effective in eliminating most apneas. Patients with mild OSA sometimes comply poorly with CPAP treatment, but those with more severe OSA tend to have higher, sustained compliance.58 For OSA patients, CPAP has been shown unequivocally to alleviate excessive daytime sleepiness;29;30 restore quality of life;31; improve vigilance;19 concentration;20 fatigue;32;33 memory;20; reduce use of health care services;35; and decrease traffic accidents.25 Most recovery is seen within a year of treatment, but improvement in mood has been observed only after 2 years of CPAP treatment.25 For patients with comorbid primary depression and OSA, recommendations are to treat the sleep apnea to facilitate managing the depression.21

Despite continuing debate in this expanding field, appropriate provision of health care for patients with OSA appears to be economically beneficial. Treated
How, what, and why of sleep apnea

Table 4. Advantages and disadvantages of treatments for obstructive sleep apnea (OSA)

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
<th>LEVEL OF EVIDENCE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight loss</td>
<td>Can help improve overall health and lessen the severity of OSA</td>
<td>Process is slow and resumption of normal weight might not fully treat OSA</td>
<td>250</td>
</tr>
<tr>
<td>Continuous positive airway pressure (CPAP)</td>
<td>Very effective and less invasive than other methods; effectively treats obstructive and central apneas and lessens snoring. Moderately lowers blood pressure after short-term use</td>
<td>Must be used nightly for life. Can have poor compliance due to discomfort with machine, especially for patients with mild sleep apnea</td>
<td>355,158</td>
</tr>
<tr>
<td>Surgery</td>
<td>More convenient than other forms of therapy (ie, no nightly appliances or modifications required)</td>
<td>Requires careful screening because successful in only carefully selected cases</td>
<td>455</td>
</tr>
<tr>
<td>Oral devices</td>
<td>An alternative for patients who cannot tolerate CPAP. High compliance (~90%)</td>
<td>Treatment fails in 37% to 46% of patients. Not fully effective in reducing apneic events. Long-term effects on oral anatomy unknown</td>
<td>340</td>
</tr>
<tr>
<td>Modification of body position</td>
<td>Can lessen severity of OSA and reduce snoring</td>
<td>Difficult to enforce and might not fully treat OSA</td>
<td>455</td>
</tr>
<tr>
<td>Oxygen administration</td>
<td>Improves oxygenation and hypopneas, some of the main effects of OSA disorders</td>
<td>Does not reduce apneas or improve daytime sleepiness. Might be useful only as an adjunct to CPAP</td>
<td>355</td>
</tr>
<tr>
<td>Pharmaceutical agents, eg, serotonin reuptake inhibitors, theophylline, naloxone, or bromocriptine</td>
<td>Most patients prefer this more convenient mode of treatment</td>
<td>Serotonin reuptake inhibitors show promise, but do not reduce daytime sleepiness. Theophylline, naloxone, and bromocriptine do not significantly reduce hypopneas</td>
<td>254, 355</td>
</tr>
</tbody>
</table>

*As described in Sackett.

patients use far fewer physician services and are less frequently hospitalized. A few studies report that, in the short term, CPAP treatment lowers blood pressure, improves cardiac function, and decreases mortality. Rigorous, long-term research is essential to determine the efficacy of CPAP for continuing treatment of OSA-linked hypertension and cardiovascular morbidity and to confirm that CPAP treatment improves long-term outcome and reduces mortality among OSA patients.

Conclusion
Busy primary care physicians are routinely challenged by the need to add information about medical conditions to their store of knowledge. The substantial medical, social, and economic consequences of untreated OSA; the overwhelming number of patients who have escaped clinical detection; and the likelihood of successful treatment strongly justify screening for this disease. Routinely asking patients about loud snoring, excessive daytime sleepiness, and unsatisfactory sleep will better serve primary care patients and advance diagnosis and treatment of OSA.

Contributors
Dr Chung formulated and conducted the research and wrote the final text of the paper. Ms Jairam assisted with the research and helped to write the early versions of the paper. Dr Hussain assisted in formulating the research idea, co-wrote sections of the manuscript, and helped revise the text. Dr Shapiro assisted in formulating and conducting the research, co-wrote sections of the manuscript, and helped revise the text.

Competing interests
None declared

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References
How, what, and why of sleep apnea

CME

Editor's key points

• Sleep apnea, which affects 2% to 5% of adults, is a serious condition that can adversely affect patients' lives.
• A diagnosis of sleep apnea should be considered if patients have any of the following symptoms: snoring, irregular breathing during sleep, unrefreshing sleep, excessive daytime somnolence, weight gain or being over weight, irritability, mood swings, and loss of libido.
• The continuous positive airway pressure (CPAP) system is the most efficacious treatment according to the literature.

Points de la rédacteur

• L'apnée du sommeil est un problème qui touche de 2 à 5% des adultes et qui présente une co-morbidité importante en plus d'affecter la qualité de vie des patients.
• On doit souperçonner ce diagnostic en présence des symptômes suivants: ronflement, irrégularités dans la fréquence respiratoire durant le sommeil, sommeil non récupérateur, somnolence diurne excessive, gain de poids ou surcharge pondérale, irritabilité, changements de l'humeur et perte de la libido.
• Le système «CPAP» (continuous positive airway pressure) sont les traitements les plus efficaces selon la littérature scientifique.