Sleep Apnea and the Eye

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Types of Sleep Apnea

Central Sleep Apnea (.4%)
Obstructive Sleep Apnea (OSA). 84%
Mixed (15%)

Apnea is Greek word meaning "without breath"
Needs to be part of history

Central Sleep Apnea
Break in respiratory effort
Improper central command
Uncommon
Known as Cheyne-Stokes syndrome

Obstructive Sleep Apnea
Soft tissues of the throat collapse and occlude airway
Happens continually during sleep cycle
Occlusion of airway leads to decreased blood oxygen
Brain then signals body to "wake up" and breathe

OSA
Most common in overweight/obese men
Gasping episodes
Snoring very common
Symptoms of daytime sleepiness
Cognition problems
Restless sleep, morning headaches

No financial disclosures
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“Pickwickian Syndrome”
Comes from the "fat boy" character in Charles Dickens novel "The Pickwick Papers"
Refers to the character traits and general habitus of OSA patients

OSA
Each pause in breathing is an “apnea”. Last seconds to minutes
Each low breathing event is called a hypopnea
Risk factors include obesity, age, male, smoking, neck circumference over 48 cm (19 inches)

Signs and Risks

<table>
<thead>
<tr>
<th>Snoring</th>
<th>BMI</th>
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<tbody>
<tr>
<td>Tiredness</td>
<td>Age (&gt;50)</td>
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<tr>
<td>Observed stop in breathing</td>
<td>Neck Size (19 inches)</td>
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<tr>
<td>Pressure (increased BP)</td>
<td>Gender (Male)</td>
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OSA
Very, very sensitive sign........
Snoring that stops

Sleeping partners aware
Sufferer almost never aware during sleep, but experiences associated problems during the day

OSA systemic complications
Heart disease
Hypertension (due to increased epinephrine and norepinephrine production)
HTN induced by sleep apnea does not decrease with sleep
Stroke and atrial fibrillation

Interestingly, OSA patients who have a non-fatal heart attack often have less residual damage.
Perhaps their tissue is more used to ischemia from chronic poor oxygen delivery.
OSA statistics

- Incidence varies widely in the literature
- High end of up to 24% of M and 9% of F
- 80% of men and 90% of women with OSA are undiagnosed
- Only 10% of people with OSA are actually treated
- 70% of obese individuals have OSA
- 50% of heart disease patients have OSA
- 72% of stroke patients have sleep apnea!!!!!!!!! (meta analysis of 29 studies and well over 2000 patients)
- 80% of patients with difficult to control hypertension have OSA
- African Americans at 2.5 X risk
- High incidence in psychiatric populations
- And most importantly.......34% of NFL Linemen have OSA!

Cancer and OSA

- April 2014 issue of the Journal of Clinical Sleep Medicine
- Patients with OSA followed for 20 years had, compared to normals..........
- Cancer incidence was 2.5 X higher with OSA
- Cancer mortality was 3.4 X higher

Mortality and OSA

- 2015 study of over 3 million US veterans (93% male)
- Untreated OSA = 86% higher mortality risk compared to non-OSA
- CPAP treated OSA = 35% higher mortality risk compared to non-OSA

Diagnosis of OSA

- Epworth sleepiness scale
- Uses self report of likelihood of falling asleep during separate activities
- Scored on a scale up to 24 points
- 0 = unlikely
- 1 = slight
- 2 = moderate
- 3 = high
Diagnosis of OSA

Pulse oximetry
Performed at home
Measures blood oxygen levels at various times during the night
Low blood oxygen is called hypoxemia

Diagnosis of OSA

Gold standard is Polysomnography sleep study
Inconvenient and problematic for many patients because they must stay overnight
“Hooked up” to a large number of machines
EEG for brain waves
EOG for eye movements
EMG for muscle activity
Measurement of oral and nasal air flow
Measurement of chest / abdominal movement
Audio snoring recording
Oximetry and video

Sleep study order IU Health

Prices at different facilities range from $3000.00 to $5000.00
Small false negative rate with single night test: about 3%

Diagnosis of OSA

AHI= Apnea Hypopnea Index
5-15 events per hour = mild OSA
15-30 = Moderate OSA
> 30 = Severe OSA

RDI = Respiratory Disturbance Index
5-15 events per hour = mild OSA
15-30 = Moderate OSA
> 30 = Severe OSA

Home testing devices starting to gain favor. Driven by insurance carriers due to cost of PSG. About $800

Treatment options for OSA

Lose weight!
Stop smoking
Avoid alcohol
Avoid sleeping pills
Sleep on side
Acetazolamide (lowers blood PH and encourages respiration)

Dental appliances (OAT)
Move lower jaw forward to keep airway open
Makes TMJ worse!
75% effective in mild and moderate OSA

Pillar procedure
Performed in office with anesthetic and syringes
Inserts Dacron strips into soft palate to keep airway open
Treatment options for OSA

**CPAP**
- Continuous Positive Airway Pressure
- A machine and mask combine to provide a continuous flow of air to "force" airway open
- Amount is titrated, but continuous

Many different manufacturers of "machines" and "masks"
- Masks can be nasal or more full face
- Less than 50% of people stick with therapy

Uncomfortable
- Noisy
- Difficult when traveling
- No "point of use" satisfaction

When CPAP does not work

**Auto titrating CPAP**
- Continually adjusts flow pressure automatically

**BiPAP**
- Delivers higher dosing, and has a different pressure between inhaling and exhaling

For both, usually must try CPAP first (insurance)

Surgical options for OSA

**Maxillo-Mandibular Advancement (MMA)**
**Uvulopalatopharyngplasty (UPPP)**
- Tongue reduction surgery (seriously!)

Some newer options........

1) **Provent**: band-aid like device covering each nostril with center valve creating pressure. $70 per one month supply
2) **Winx**: Small mouthpiece that rests inside the mouth and creates suction to open airway. $700
3) **Inspire upper airway stimulation**: stimulates nerves to keep airway open. Surgical procedure. Now FDA approved but insurance concerns. Can’t do if BMI over 32

Potential New Drug

**Dronabinol**
- A synthetic cannabis / THC compound
- Positive results in phase 2 trials
- Jury is out until larger phase 3 trials are conducted

Would be the first pharmaceutical agent specifically for OSA
Alternative treatment for OSA

Playing the didgeridoo!
Strengthens muscles in the throat thus preventing night time collapse
Proven effective in a 2005 study in the British Journal of Medicine

Ocular Side effects of OSA

Floppy Eyelid Syndrome (FES)
Keratoconus
NAION
Glaucoma, especially NTG
Papilledema
ICSC
CPAP side effects

Floppy Eyelid Syndrome

First described in 1981 by Culberston and Ostler
Less than 5% of people with OSA have FES………………but essentially 100% of people with FES have OSA
Most commonly overweight men
Eyelids are very loose and rubbery
Evert easily with minimal pressure
Associated with keratoconus:
Rubbing vs. elastic issue
Moderate and severe OSA patients have a much higher rate of substantial Conjunctivochalasis

CPAP side effects

Dry eye and irritation secondary to air leakage around mask
Increased incidence of bacterial conjunctivitis: probably related to above
• Possible increased IOP during use: up to 5-8 points: ? If on glaucoma therapy

Recent study

Study of 31 new CPAP users and 20 non-CPAP users
Showed no increase in IOP with CPAP use
Small sample size
Not evaluated long term (new to CPAP use)
Take home message: unclear if CPAP use increases IOP or not, as studies conflict

Floppy Eyelid Syndrome

Lash ptosis very common
Typically improves with control of OSA
Relationship unclear, but may be due to changes in MMP leading to increased elasticity of tissue

Problem comes when lids contact the pillow during sleep and evert or open

UNDERDIAGNOSED
FES

Lash ptosis

Symptoms of F.E.S.
- Dry, gritty, irritated eye or eyes upon awakening that get better as the day goes on
- If patient always sleeps on one side, only that eye is affected
- Punctate Keratitis
- Conjunctivitis
- Mucous discharge
- Can then get Mucous Fishing Syndrome

Treatment of F.E.S.
- Patient education
- Weight loss and management of OSA
- Night time lubricating ointment
- Sleep with cylinder pillow ("dog bone" pillow)
- Use firm sleep mask
- Taping of lids (no one complies with this)
- Surgical resection of tissue
Study Regarding FES and Glaucoma

Journal of Glaucoma 2014: 23; (1)

1) 75 patients with OSA but no FES
2) 52 patients with OSA and FES
3) 25 patients without OSA

% of patients with glaucoma of any type:
1) 5%
2) 23%
3) 0%

Papilledema

Some patients with OSA have increased ICP at night.
Lumbar tap opening pressure tends to be normal during waking hours.
Can lead to papilledema if severe enough.

Papilledema

Association unclear.
Perhaps just having obesity as a common risk factor.
But if so, why is ICP up only at night?
Also, treatment with CPAP decreases ICP.
Consider especially in males with IIH.

I.C.S.C. (Central Serous)

Recently linked in some patients to OSA.
Unknown cause, perhaps related to increased epinephrine causing increased catecholamine levels.
Keep possible link in mind.

Glaucoma

OAG and NTG are both more common in patients with OSA.
Prevalence in various studies is highly variable.
Highest in literature are 27% of OSA patients in one study with OAG, 43% in another with NTG.

Most are much lower, but still well above the rate in the general population.

Especially common in NTG patients who progress despite very low IOP.

Especially common in NTG patients who progress despite very low IOP.
Study on glaucoma with OSA


Meta-analysis of 6 studies, 3 cohort and 3 case control

Considered multiple types of glaucoma

Overall

Cohort studies showed a combined 1.43 fold risk of glaucoma with OSA

Case control studies showed a 2.46 fold risk

Overall a 72% increase in risk

Interestingly, no statistical increase in POAG. May be biased by inclusion of Chinese data with high rate of ACG

NTG

Could OSA possibly explain Drance Hemorrhages?

How about the propensity for paracentral VF defects?

NAION

Nonarteritic ION

Swollen, hyperemic nerve with splinter hemorrhages and exudates

Often sectoral

NAION has 5x risk of sleep apnea, 8x risk in women compared to the general population

Nonarteritic ION

Often APD, color vision usually normal

Most frequent visual field defect is inferior nasal/partial altitudinal but may get essentially any type.

FDT may be more sensitive and often shows spillover of loss in to “non-affected” hemifield

After swelling resolves, the nerve is pale but often not cupped-cupping may occur, however

Why does area of swelling not always match VF defect?

NAION 2 weeks after initial symptoms
**NAION**

- VA varies widely from normal to severe loss: 45% 20/40 or better but 33% 20/200 or worse
- VA loss progresses over 2-4 weeks
- VA improves by up to three lines at six months in 40%
- In patients under 50 years of age, there is a higher rate of bilateral involvement and more visual recovery

**Nonarteritic Etiologies**

1) Sleep Apnea! Up to 90%
2) Hypertension (40%) (med related?)
3) Idiopathic
4) Diabetes
5) Atherosclerosis
6) Migraine
7) Increased Homocysteine / Decreased vitamin B6
8) ED drugs / amiodarone
9) HIV

**Nonarteritic ION**

- Approximately 15% of cases will involve the fellow eye in 5 years. Repeat attacks in same eye < 5%

- No consistently proven treatment. Can consider oral steroids when VA 20/70 or worse, but controversial
- Can consider aspirin to help prevent fellow eye attack. Also controversial

**Bilateral NAION secondary to OSA (40% blood oxygen level)**
Accompanying VF

Case example
NAION OD leads to diagnosis of OSA after sleep studies are performed
Patient was prescribed CPAP but did not comply with use

Following pictures illustrate course of events.

NAION OD: The Beginning

Optic atrophy / incipient ION

NAION OS

Optic atrophy OU
Post op (complete hysterectomy) NAION

Incipient ION

We see it coming, but can we do anything about it?

Will it always end badly?

Final thought: Diabetic patients with OSA have 50% greater risk of severe retinopathy (Macular edema or PDR)