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

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

Central Sleep Apnea

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

OSA

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

Risks and signs

- Snoring
- Tiredness
- Observed stop in breathing
- Pressure (increased BP)

BMI
- Age (>50)
- Neck Size (19 inches)
- Gender (Male)

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
Untreated OSA patients have yearly medical costs $1336 greater on average than those without OSA

OSA statistics

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

0 = unlikely
1 = slight
2 = moderate
3 = high

Scored on a scale up to 24 points
Diagnosis of OSA

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

**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

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

**RDI = Respiratory Disturbance Index**

Less common tests include sleep latency and maintenance of wakefulness tests

**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 on to 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

Treatment options for OSA

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
Studies show that CPAP use actually increases BMI. Due to decreased basal metabolic rate

When CPAP does not work

Auto titrating CPAP
Continually adjusts flow pressure automatically
BJPAP
Delivers higher dosing, and has a different pressure between inhaling and exhaling

Surgical options for OSA

Maxillo-Mandibular Advancement (MMA)
Uvulopalatopharyngealplasty (UPPP)

Some new 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

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

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

Most 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
- First described in 1981 by Culberston and Ostler
- Most commonly overweight men
- Eyelids are very loose and rubbery
- Evert easily with minimal pressure
- Associated with keratoconus: Rubbing vs. elastic issue

Floppy Eyelid Syndrome
- Lash ptosis very common
- Typically improves with control of OSA
- Relationship unclear, but may be due to increased MMP leading to decreased elasticity of tissue
- UNDERDIAGNOSED!

FES
FES

Lash ptosis

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

New 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.

Glaucoma
Believed to be related to poor blood flow and decreased oxygen delivery to the optic nerve. Especially important to consider with NTG. Worth looking in to OSA with NTG patients who have symptoms. Especially common in NTG patients who progress despite very low IOP. Remember that CPAP therapy can raise IOP!

New study on glaucoma with OSA

Cohort studies showed a combined 1.48 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

Very highly associated with OSA

In one study of NAION patients, 12 / 17 had OSA while 3 / 17 controls did
In another, 24 / 27 had OSA

Most often, vision loss is noted upon awakening
Believed to be a hypoperfusion event leading to poor blood perfusion of optic nerve
Typically encountered in “disc at risk” patients

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 into “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

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

No systemic symptoms of GCA; normal ESR / CRP
Most common cause of ONH swelling over the age of 55 (2-10 cases per 100,000 per year)
45-60 year olds (any age possible) with no sex predilection; C > AA

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

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

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

NAION
FELLOW EYE
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