

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



“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

Snorring

BMI

Tiredness

Age (>50)

Observed stop in breathing

Neck Size (19 inches)

Pressure (increased BP)

Gender (Male)

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)

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

Narcolepsy

Harvard Medical School | Division of Sleep Medicine | Sleep and Health Education

Epworth Sleepiness Scale

This scale is used to determine a person's level of daytime sleepiness. On the following scale, rate the most appropriate number for each situation.

- 0 = would never do it
- 1 = a slight chance of doing it
- 2 = a moderate chance of doing it
- 3 = high chance of doing it

The items on your copy of this report form. Have you had? (Rate each of these things recently, by the week or more than once per month, as it applies to you. It is important that you answer each question as best as you can.)

Situation	Chance of doing it (rating)
Sleeping and reading	
Watching TV	
Sitting in a car for an hour	
Sitting at a meeting or in class for an hour	
Lying down in the afternoon	
Sitting and talking to someone	
Sitting quietly after lunch or at work	
Sitting for a long time in a public place (e.g., waiting for a train)	
Total Epworth score	

UNDERSTANDING YOUR SCORE

- 0-10: Normal range - healthy adults
- 11-14: Mild sleepiness
- 15-17: Moderate sleepiness
- 18 or higher: Severe sleepiness

If you scored 11 or higher, consider seeing a sleep medicine specialist to diagnose and treat the cause of your sleepiness.

Revised 04/01/2009

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

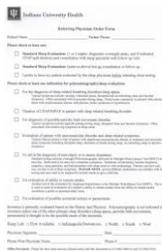
Measurement of oral and nasal air flow

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

RDI = Respiratory Disturbance Index

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

Treatment options for OSA

Pillar procedure

Performed in office with anesthetic and syringe

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



Treatment options for OSA

Many different manufacturers of "machines" and "masks"

Uncomfortable

Masks can be nasal or more full face

Noisy

Difficult when traveling

Less than 50% of people stick with therapy

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)

Uvulopalatopharyngo-plasty (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

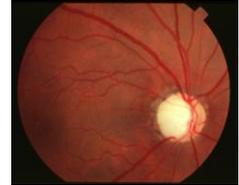
NAION

Glaucoma, especially NTG

Papilledema

ICSC

CPAP side effects

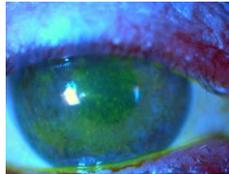


CPAP side effects

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

Graefes Arch Clin Exp Ophthalmol (2015) 253:2263-2271

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

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

Floppy Eyelid Syndrome

Lash ptosis very common

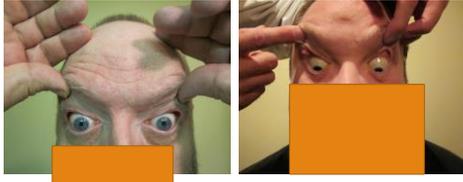
Typically improves with control of OSA

Relationship unclear, but may be due to changes in MMP leading to increased elasticity of tissue

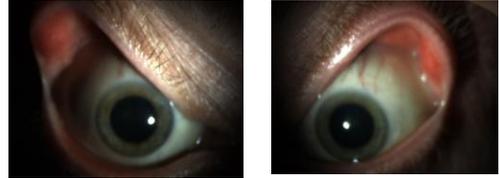
Problem comes when lids contact the pillow during sleep and evert or open

UNDERDIAGNOSED

FES



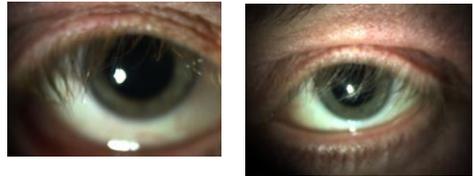
FES



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!)

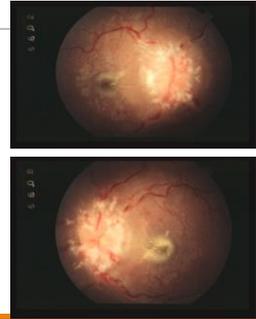
Surgical resection of tissue

Study Regarding FES and Glaucoma

Journal of Glaucoma 2014: 23; (1)	% of patients with glaucoma of any type.....
1) 75 patients with OSA but no FES	1) 5%
2) 52 patients with OSA and FES	2) 23%
3) 25 patients without OSA	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



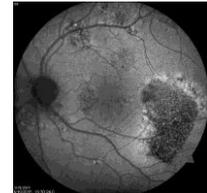
Papilledema

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 IHH



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



Study on glaucoma with OSA

Journal of Glaucoma 2016; 25:1-7

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

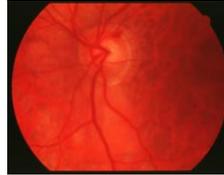
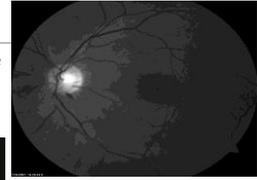
Overall a 72% increase in risk

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

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

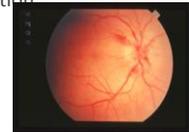
Typically encountered in "disc at risk" patients. New information indicates possible role for thick peripapillary choroid: Peripapillary pachychoroid. Can be measured by OCT

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

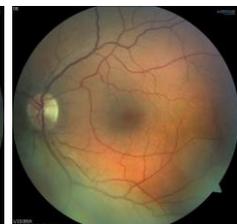
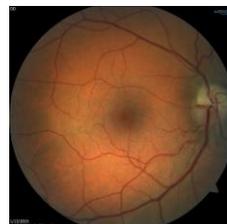
Often APD, color vision usually normal

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

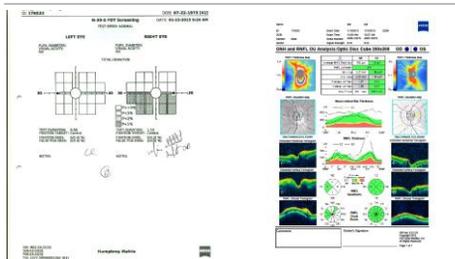
After swelling resolves, the nerve is pale but often not cupped-cupping may occur, however

Why does area of swelling not always match VF defect?

NAION 2 weeks after initial symptoms



NAION



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

NAION

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
- 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%

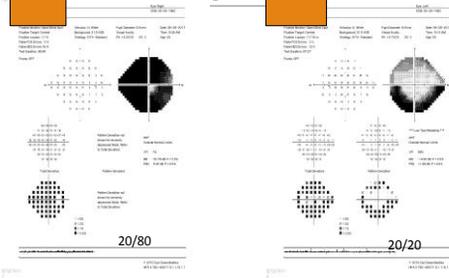
No consistently proven treatment. Can consider oral steroids when VA 20 / 70 or worse, but controversial

Can consider aspirin to help prevent fellow eye attack. Also controversial

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



Accompanying VF



Case example

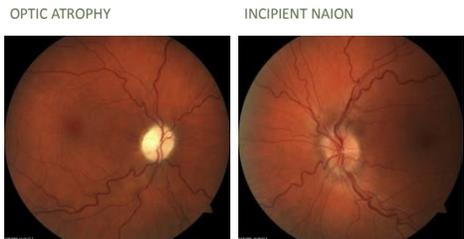
NAION OD leads to diagnosis of OSA after sleep studies are performed
 Patient was prescribed CPAP but did not comply with use

Following pictures illustrate course of events.....

NAION OD: The Beginning



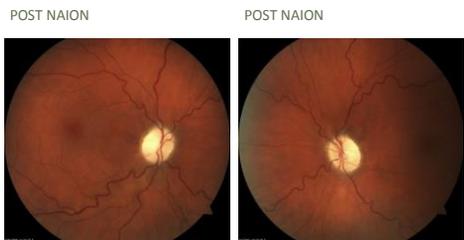
Optic atrophy / incipient ION



NAION OS



Optic atrophy OU



Post op (complete hysterectomy) NAION

OD

OS



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)

