

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



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Central Sleep Apnea

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



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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



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OSA

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



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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



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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)



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Signs and Risks

<u>S</u> norring	<u>B</u> MI
<u>T</u> iredness	<u>A</u> ge (>50)
<u>O</u> bserved stop in breathing	<u>N</u> eck Size (19 inches)
<u>P</u> ressure (increased BP)	<u>G</u> ender (Male)

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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

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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

Increased LDL, triglycerides, and total cholesterol; decreased HDL

2 x incidence of gout



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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.



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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). Higher rate of recurrent ischemic stroke as well.

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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 lineman 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 with OSA

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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

Unrelated to this study: for every standard deviation that the AHI is above the mean, there is 215 days of biological age acceleration

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

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Epworth Sleepiness Scale
 This scale is used to determine a person's level of daytime sleepiness.

In the following situations, how likely are you to doze off or fall asleep, or compare to not feeling tired?
 Use the following scale to provide the most appropriate answer for each situation:
 0 = not at all likely
 1 = slight chance of dozing or sleeping
 2 = moderate chance of dozing or sleeping
 3 = high chance of dozing or sleeping

This refers to your awareness of the 6 recent times. Even if you haven't done some of these things recently, try to work out how you would have responded, or to respond to the situation that you would most likely have to face.

Situation	Chance of dozing or sleeping
Sitting and reading	
Watching TV	
Sitting in a car in a public place	
Sitting in a car in a private place	
Lying down in the afternoon	
Sitting and talking to someone	
Sitting quietly after lunch (not alcohol)	
Sitting for a few minutes in traffic while driving	
Total Epworth score	

UNDERSTANDING YOUR SCORE
 0-5: Normal range - healthy sleep
 6-10: Mild sleepiness
 11-15: Moderate sleepiness
 16-20: Severe sleepiness
 21 or higher: Severe sleepiness

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

Diagnosis of OSA

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



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Treatment options for OSA

Many different manufacturers of "machines" and "masks"	Uncomfortable
Masks can be nasal or more full face	Noisy
Less than 50% of people stick with therapy	Difficult when traveling
	No "point of use" satisfaction

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When CPAP does not work

Auto titrating CPAP	BiPAP
Continually adjusts flow pressure automatically	Delivers higher dosing, and has a different pressure between inhaling and exhaling
	For both, usually must try CPAP first (insurance)

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Surgical options for OSA

Maxilo-Mandibular Advancement (MMA)

Uvulopalatopharyngo-plasty (UPPP)

Tongue reduction surgery (seriously!)



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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. FDA approved but insurance concerns. Can't do if BMI over 32

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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

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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*



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Ocular Side effects of OSA

Floppy Eyelid Syndrome (FES)

Keratoconus

NAION

Glaucoma, especially NTG

Papilledema

ICSC

CPAP side effects

Increased risk of CRVO, and of sight threatening retinopathy in diabetic patients (macular edema and PDR)



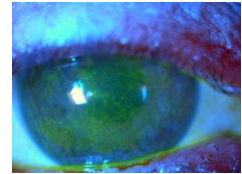
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CPAP side effects

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



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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

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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

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Floppy Eyelid Syndrome

Lash ptosis very common (some Asian patients have this normally)

Typically improves with control of OSA

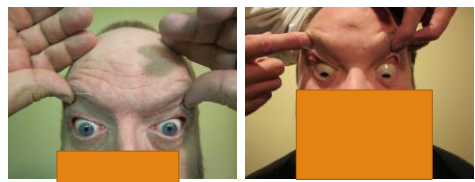
Relationship unclear, but may be due to changes in MMP leading to increased elasticity of tissue

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

UNDERDIAGNOSED

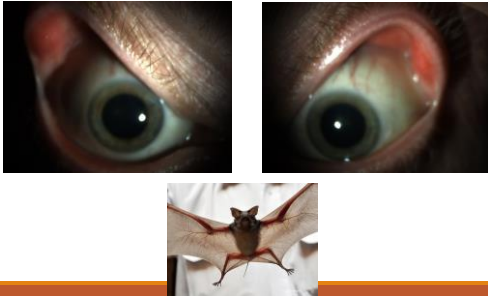
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FES



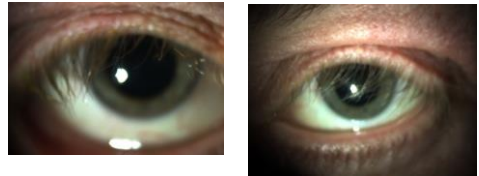
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FES



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Lash ptosis



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Lash ptosis



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CPAP issue



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CPAP issue.....



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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

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Treatment of F.E.S.

- | | |
|--|---|
| Patient education | Taping of lids (no one complies with this!) |
| Weight loss and management of OSA | Surgical resection of tissue |
| Night time lubricating ointment | |
| Sleep with cylinder pillow ("dog bone" pillow) | |
| Use firm sleep mask | |

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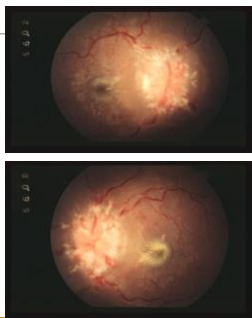
Study Regarding FES and Glaucoma

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%

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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



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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 IH



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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

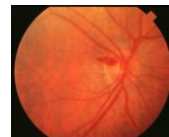


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Glaucoma

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
 OSA + Hypertension = 2.67 times risk of PXF glaucoma

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



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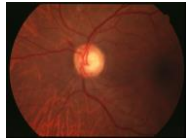
Glaucoma

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 patients who have symptoms

Especially common in NTG patients who progress despite very low IOP



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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

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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

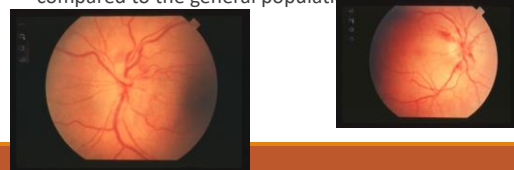
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Nonarteritic ION

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



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Nonarteritic ION

Often APD, color vision usually normal

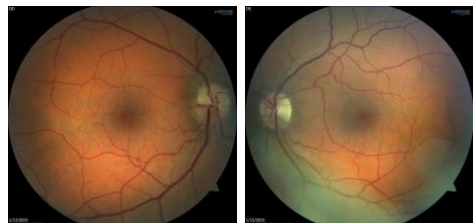
Most frequent visual field defect is inferior nasal / partial altitudinal but may get essentially any type. FDT may be more sensitive and often shows spillover of loss in to "non-affected" hemifield

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?

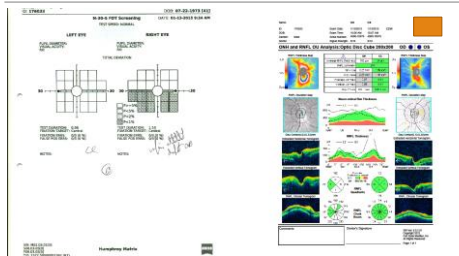
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NAION 2 weeks after initial symptoms



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NAION



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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

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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

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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

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Nonarteritic ION

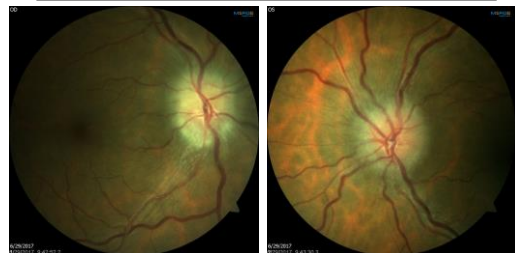
Approximately 15% of cases will involve the fellow eye in 5 years. Repeat attacks in same eye < 5%

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

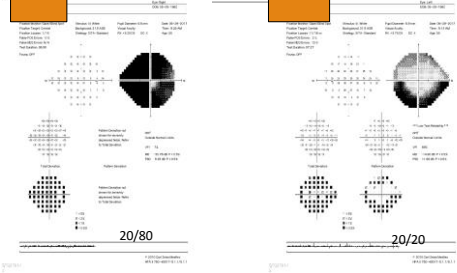
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Bilateral NAION secondary to OSA (40% blood oxygen level)



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Accompanying VF



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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.....

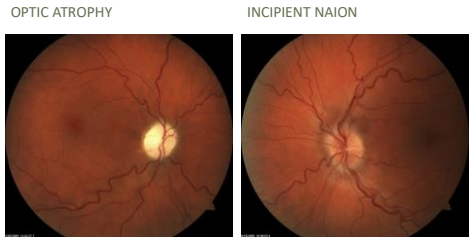
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NAION OD: The Beginning



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Optic atrophy / incipient ION



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NAION OS



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Optic atrophy OU

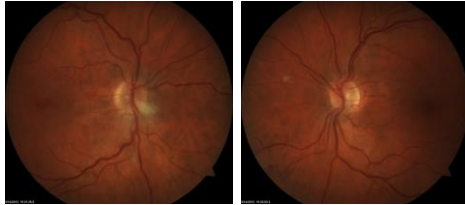


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Post op (complete hysterectomy) NAION

OD

OS



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Incipient ION

We see it coming, but can we do anything about it? Only deal with any underlying issues.

Will it always end badly? Not necessarily.



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