Course Title: Sleep Apnea and the Eye

Lecturer: Brad Sutton, OD, FAAO
IU School of Optometry
Clinical Professor

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

Sleep Apnea and the Eye

- No financial disclosures
“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)

OSA

• Very, very sensitive sign………

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

• 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
- Untreated OSA patients have yearly medical costs $1336 greater on average than those without OSA
- Only 10% of people with OSA are actually treated
- 70% of obese individuals have OSA
- 50% of heart disease patients have OSA
- 60% of stroke patients have OSA
- 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
- Cancer incidence was 2.5 X higher with OSA
- Cancer mortality was 3.4 X higher

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
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

Diagnosis of OSA

- AHI = Apnea Hypopnea Index
- RDI = Respiratory Disturbance Index

- 5-15 events per hour = mild OSA
- 15-30 = Moderate OSA
- > 30 = Severe OSA

- Less common tests include sleep latency and maintenance of wakefullness tests

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

Sleep study order IU Health

- Prices at different facilities range from $3000.00 to $5000.00!!!!!!!

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
- Make 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 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

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)
- Uvulopalatopharyngoplasty (UPPP)
- Tongue reduction surgery (seriously!)

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. Not yet FDA approved.

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 or nose to eye
- Increased incidence of bacterial conjunctivitis; probably related to above
- Increased IOP during use: up to 5-8 points? If on glaucoma therapy

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

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

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

UNDERDIAGNOSED!

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
- 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 into OSA with NTG patients who have symptoms

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

- 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 (27%)
- 4) Diabetes (17%)
- 5) Atherosclerosis (14%)
- 6) Migraine (12%)
- 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

Optic atrophy / incipient ION

Optic atrophy OU

NAION OS

Post NAION
Post op (complete hysterectomy)
NAION

- We see it coming, but can we do anything about it?
- Will it always end badly?

Incipient ION

- Final thought: Diabetic patients with OSA have 50% greater risk of severe retinopathy