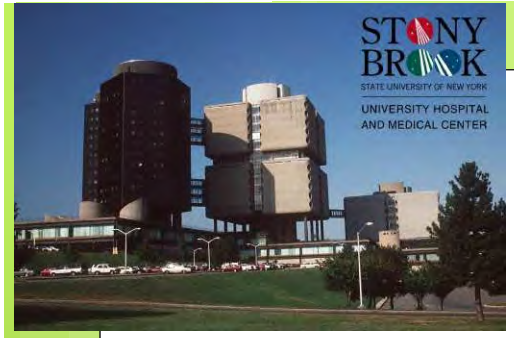


Pre-Operative Services Teaching Rounds 11 March 2011

Deborah Richman MBChB FFA(SA)
Director – Pre-Operative Services
Department of Anesthesia
Stony Brook University Medical Center, NY
drichman@notes.cc.sunysb.edu

Obstructive sleep apnea:

- Pathophysiology
- Comorbidities
- Screening
- Diagnosis
- Treatment

- Perioperative management
  - Testing
  - Location
  - Timing
  - Anesthesia plan
  - Post-operative disposition
    - Monitoring
    - treatment

Case

63 yr old lady for knee arthroscopy in ASC

PMH:

HTN, Obesity, GERD, OSA dx 4 months ago, not using CPAP

PSH:

Lap chole 2 years ago "difficulty waking up"

Meds:

Omeprazole, Atenolol, thiazide

Exam:

BMI 37, BP 140/90 P 65. No cardiac failure. Non-remarkable.

Airway: MP 3, FROM, 'thick neck', no dental work/loose teeth.

Definitions - Obstructive Sleep Apnea (OSA)

- Apnea: no airflow >10 sec
- Hypopnea: >50%reduction in flow >10sec
- Secondary to obstruction,
  - There is an inspiratory effort
- Measured in polysomnography
- Daytime somnolence

OSA - missed

- Don't ask
- Patients don't consider it a disease
- No medication to 'clue' us in

Obstructive sleep apnea (OSA)

- Common 4-25% of males, 2-4% of females
  - Doubles if morbidly obese
  - 70-80% undiagnosed

- Central sleep apnea
- Obstructive sleep apnea
- Mixed sleep apnea

No animals have OSA except humans

Risk factors for OSA:

- Obesity
- Neck circumference
- Age / Menopausal status
- Male gender
- Genetic predisposition

- Nasal /pharyngeal obstruction
- Laryngeal obstruction
- Craniofacial abnormalities

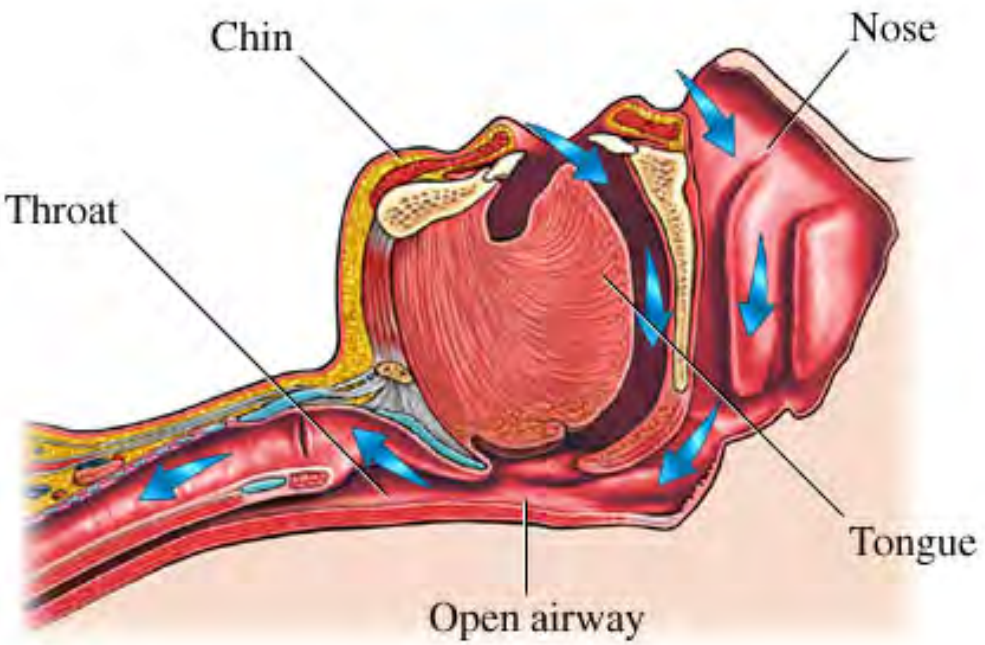
- Alcohol, sedatives, smoking
- Medications and anesthesia

- Endocrine and metabolic causes
- Neuromuscular disorders
- Connective tissue disorders

Airway
- Small / receding mandible
- Buck teeth/posterior tongue
- Large tonsils
- High Mallimpati


Nasal Passage
Soft Palate
Tongue
Collapsed Airway
© Copyright 2011 - HealthTree.com, a service of Tree.com Inc. All Rights Reserved.

Obstructive sleep apnea



- Tensor palatine
- Genioglossus
- Hyoid muscles – genio-/sterno-/thyro-

Pathophysiology

- Collapse of the upper airway
  - Structure
    - Obesity
    - Craniofacial abnormalities
  - Neuromuscular activity
    - Genioglossus – tone varies with phase of respiration
    - Decreased tone during sleep
    - Atonic during REM sleep
    - Resumes upon arousal
    - Loss of tone:
      - Apnea: no flow >10 sec
      - Hypopnea: >50%reduction in flow >10sec

Chemo-responsiveness

- Altered genetically/drugs/alcohol

Compounded by long term hypoxia and hypercapnea which lead to:

- Altered control of breathing
- Altered hypoxic ventilatory response
- Altered response to carbon dioxide levels

Pathophysiology

- Obstruct - Apnea/hypopnea (loss of tone)
- Arousals
- Sympathetic (BP)
- Fixed BP change
- Ventricular hypertrophy / ischemia
- Arrhythmia / death

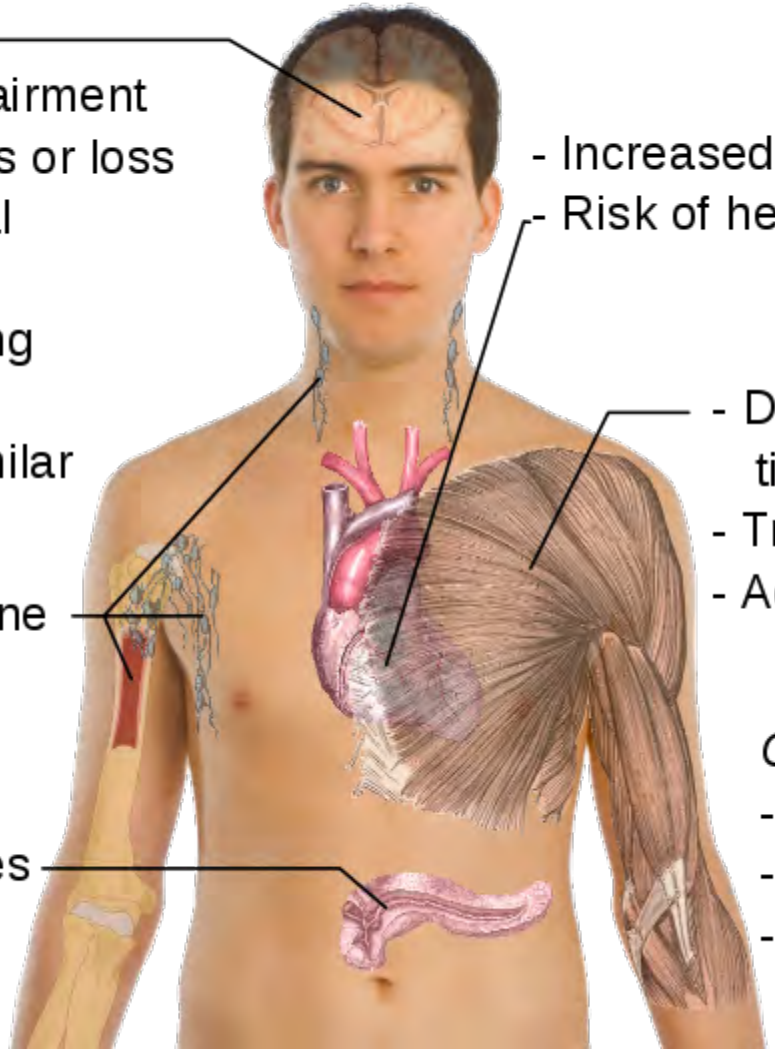
Effects of

Sleep deprivation

- Irritability
- Cognitive impairment
- Memory lapses or loss
- Impaired moral judgement
- Severe yawning
- Hallucinations
- Symptoms similar to ADHD

- Impaired immune system

- Risk of diabetes Type 2



- Increased heart rate variability
- Risk of heart disease

- Decreased reaction time and accuracy
- Tremors
- Aches

Other:
- Growth suppression
- Risk of obesity
- Decreased temperature

Comorbidities:

- Obesity
- Airway
- GERD
- Hypertension
- Cardiac disease
- Cerebrovascular disease
- Pulmonary hypertension
- Type 2 Diabetes

- Poor sleep
  - Behavioral changes
  - Cognitive dysfunction
  - Personality abnormalities
  - Motor Vehicle Accidents
- Noisy sleep
  - Social isolation

OSA Screening

Stop and Bang (Chung 2008)

- **S**noring
- **T**iredness
- **O**bserved apnea
- **P**ressure (BP)
- **B**MI (>35)
- **A**ge (>50)
- **N**eck circumference >16" female/ >17" male (40cm)
- **G**ender (male)

(*Berlin score / Flemons / ASA checklist / Epworth*)

Berlin Questionnaire

Height _____ m Weight _____ kg Age_____ Male/Female

Please choose the correct response to each question.

Category 1

1. Do you snore?

a. Yes

b. No

c. Don't know

If you snore:

2. Your snoring is:

a. Slightly louder than breathing

b. As loud as talking

c. Louder than talking

d. Very loud—can be heard in adjacent rooms

3. How often do you snore?

a. Nearly every day

b. 3–4 times a week

c. 1–2 times a week

d. 1–2 times a month

e. Never or nearly never

4. Has your snoring ever bothered other people?

a. Yes

b. No

c. Don't know

5. Has anyone noticed that you quit breathing during your sleep?

a. Nearly every day

b. 3–4 times a week

c. 1–2 times a week

d. 1–2 times a month

e. Never or nearly never

Berlin Questionnaire (cont)

Category 2

6. How often do you feel tired or fatigued after your sleep?
a. Nearly every day
b. 3–4 times a week
c. 1–2 times a week
d. 1–2 times a month
e. Never or nearly never

7. During your waking time, do you feel tired, fatigued, or not up to par?
a. Nearly every day
b. 3–4 times a week
c. 1–2 times a week
d. 1–2 times a month
e. Never or nearly never

8. Have you ever nodded off or fallen asleep while driving a vehicle?
a. Yes
b. No

If yes:

9. How often does this occur?
a. Nearly every day
b. 3–4 times a week
c. 1–2 times a week
d. 1–2 times a month
e. Never or nearly never

Category 3

10. Do you have high blood pressure?
a. Yes
b. No
c. Don’t know

Scoring: Berlin Questionnaire

Adapted from table 2 in Netzer *et al.*[7]
The questionnaire consists of three categories related to the risk of having OSA.

Categories and scoring:

Category 1: items 1, 2, 3, 4, and 5
Item 1: If *yes is the response, assign 1 point.*
Item 2: If *c or d is the response, assign 1 point.*
Item 3: If *a or b is the response, assign 1 point.*
Item 4: If *a is the response, assign 1 point.*
Item 5: If *a or b is the response, assign 2 points.*
Category 1 is positive if the total score is 2 or more points.

Category 2: items 6, 7, and 8 (item 9 should be noted separately)
Item 6: If *a or b is the response, assign 1 point.*
Item 7: If *a or b is the response, assign 1 point.*
Item 8: If *a is the response, assign 1 point.*
Category 2 is positive if the total score is 2 or more points.

Category 3 is positive if the answer to item 10 is yes or if the BMI of the patient is greater than 30 kg/m2.

High risk of OSA: *two or more categories scored as positive*
Low risk of OSA: *only one or no category scored as positive*

ASA Checklist

Adapted from Gross et al.

Category 1: *Predisposing Physical Characteristics*

a. BMI 35 kg/m2

b. Neck circumference 43 cm/17 inches (men) or 40 cm/16 inches (women)

c. Craniofacial abnormalities affecting the airway

d. Anatomical nasal obstruction

e. Tonsils nearly touching or touching the midline

Category 2: *History of Apparent Airway Obstruction during Sleep*

Two or more of the following are present (if patient lives alone or sleep is not observed by another person, then only one of the following need be present):

a. Snoring (loud enough to be heard through closed door)

b. Frequent snoring

c. Observed pauses in breathing during sleep

d. Awakens from sleep with choking sensation

e. Frequent arousals from sleep

ASA Checklist (cont)

Category 3: Somnolence

One or more of the following are present:

a. Frequent somnolence or fatigue despite adequate "sleep"

b. Falls asleep easily in a nonstimulating environment (*e.g., watching* TV, reading, riding in or driving a car) despite adequate "sleep"

c. [Parent or teacher comments that child appears sleepy during the day, is easily distracted, is overly aggressive, or has difficulty concentrating]*

d. [Child often difficult to arouse at usual awakening time]*

Scoring:

If two or more items in category 1 are positive, category 1 is positive.
If two or more items in category 2 are positive, category 2 is positive.
If one or more items in category 3 are positive, category 3 is positive.
High risk of OSA: two or more categories scored as positive
Low risk of OSA: only one or no category scored as positive

Obstructive Sleep Apnea

Clinical diagnosis: (No sleep study)

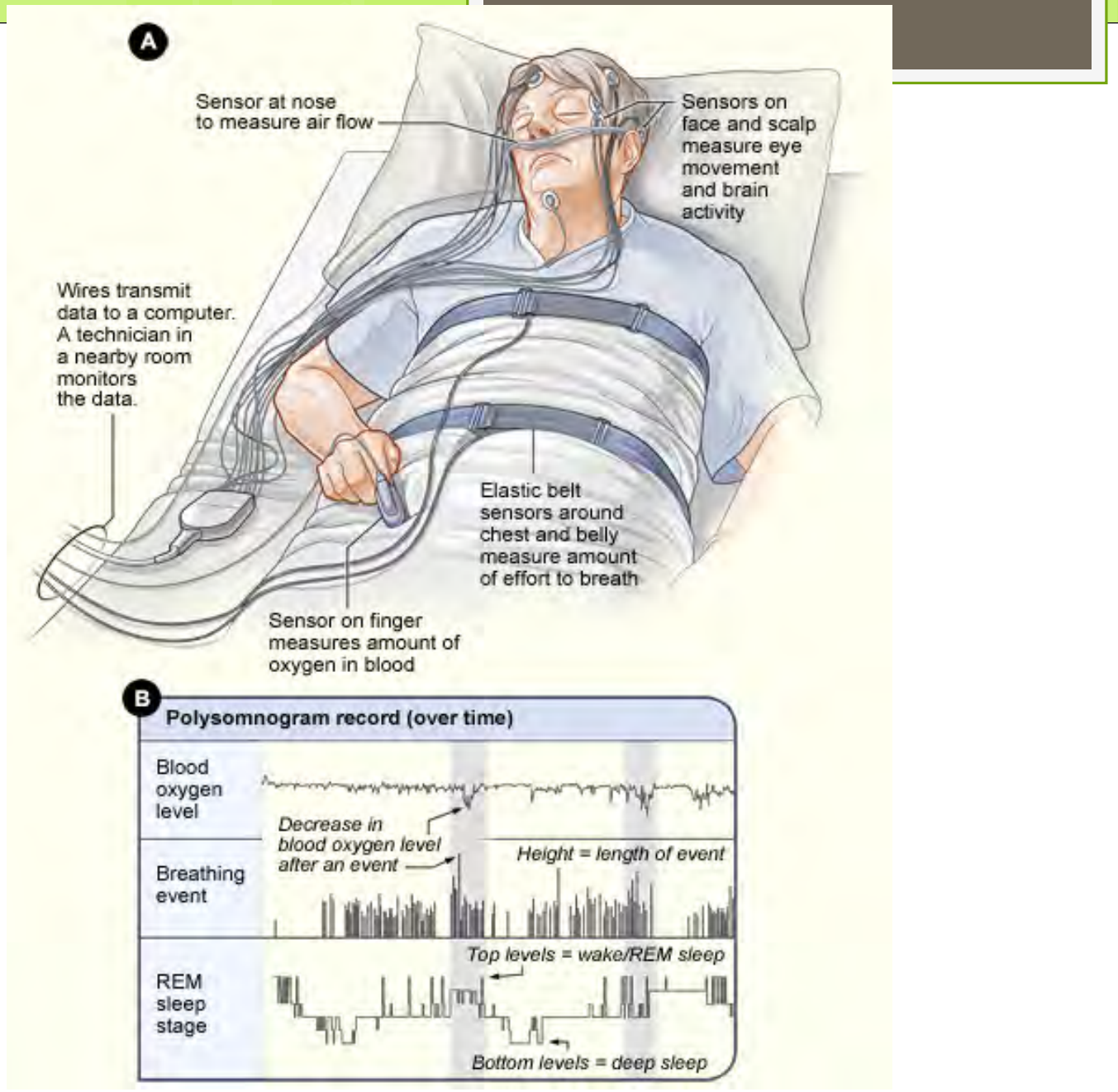
- Sleep disordered breathing (SDB)
  - Significant snoring
  - apnea
- Arousals
  - Extremity movement
  - Vocalization
  - Turning
  - Snorting
- Daytime somnolence
  - Full asleep driving/lectures/quiet times

Diagnosis

Polysomnography(PSG) is the gold standard

Done overnight in sleep center
Full night or split night with CPAP titration

Home testing

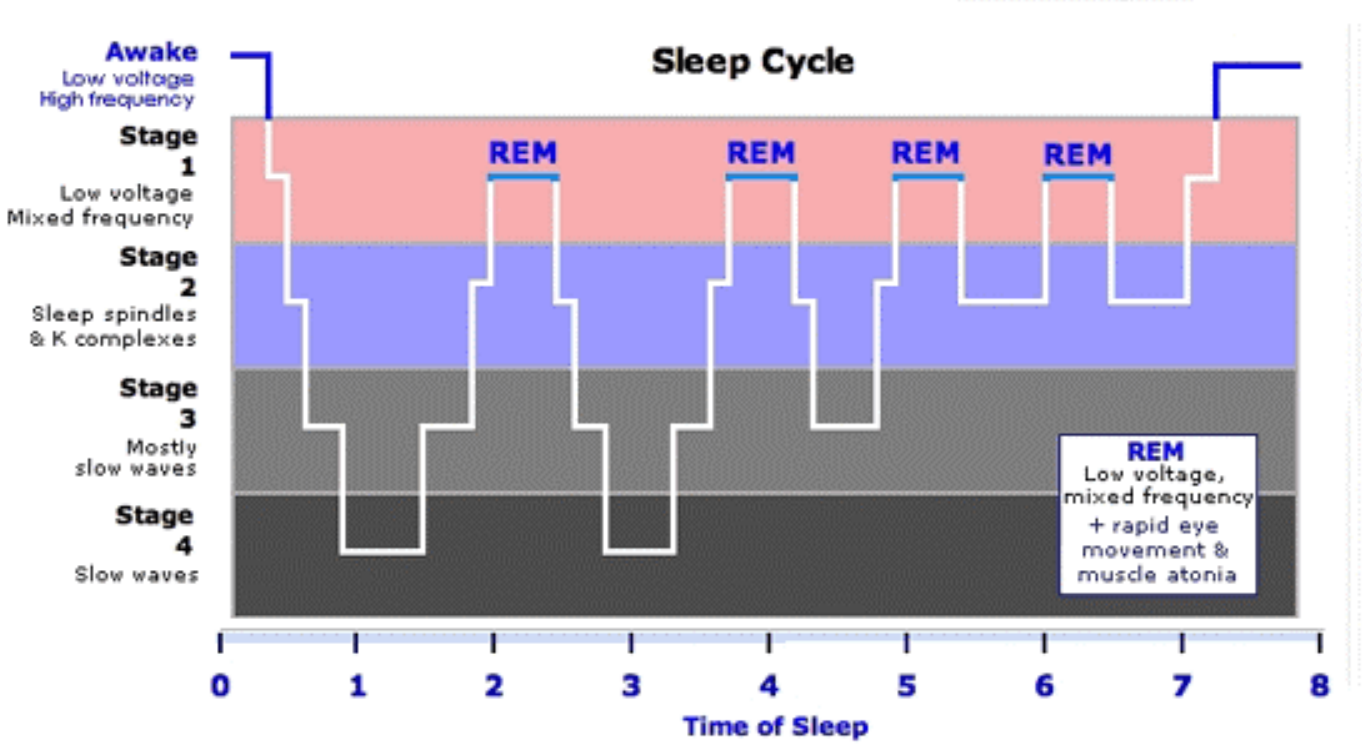

A
Sensor at nose to measure air flow
Sensors on face and scalp measure eye movement and brain activity
Wires transmit data to a computer. A technician in a nearby room monitors the data.
Elastic belt sensors around chest and belly measure amount of effort to breath
Sensor on finger measures amount of oxygen in blood
B
Polysomnogram record (over time)
Blood oxygen level
Decrease in blood oxygen level after an event
Height = length of event
Breathing event
Top levels = wake/REM sleep
REM sleep stage
Bottom levels = deep sleep

Polysomnography (PSG)

- **Apnea hypopnea index (AHI)**
  - <5 UARS(upper airways resistance syndrome)
  - **Mild 5-15**
  - **Moderate 15-30**
  - **Severe >30**
- Desaturations >4% considered significant
- Arousals (**respiratory effort related arousal:** RERA)

OSA vs. Central vs. mixed sleep apnea

Sleep architecture



OSA Treatment

Weight loss

Drugs / alcohol avoidance

Sleep hygiene

Supportive

CPAP

Appliances

Surgery

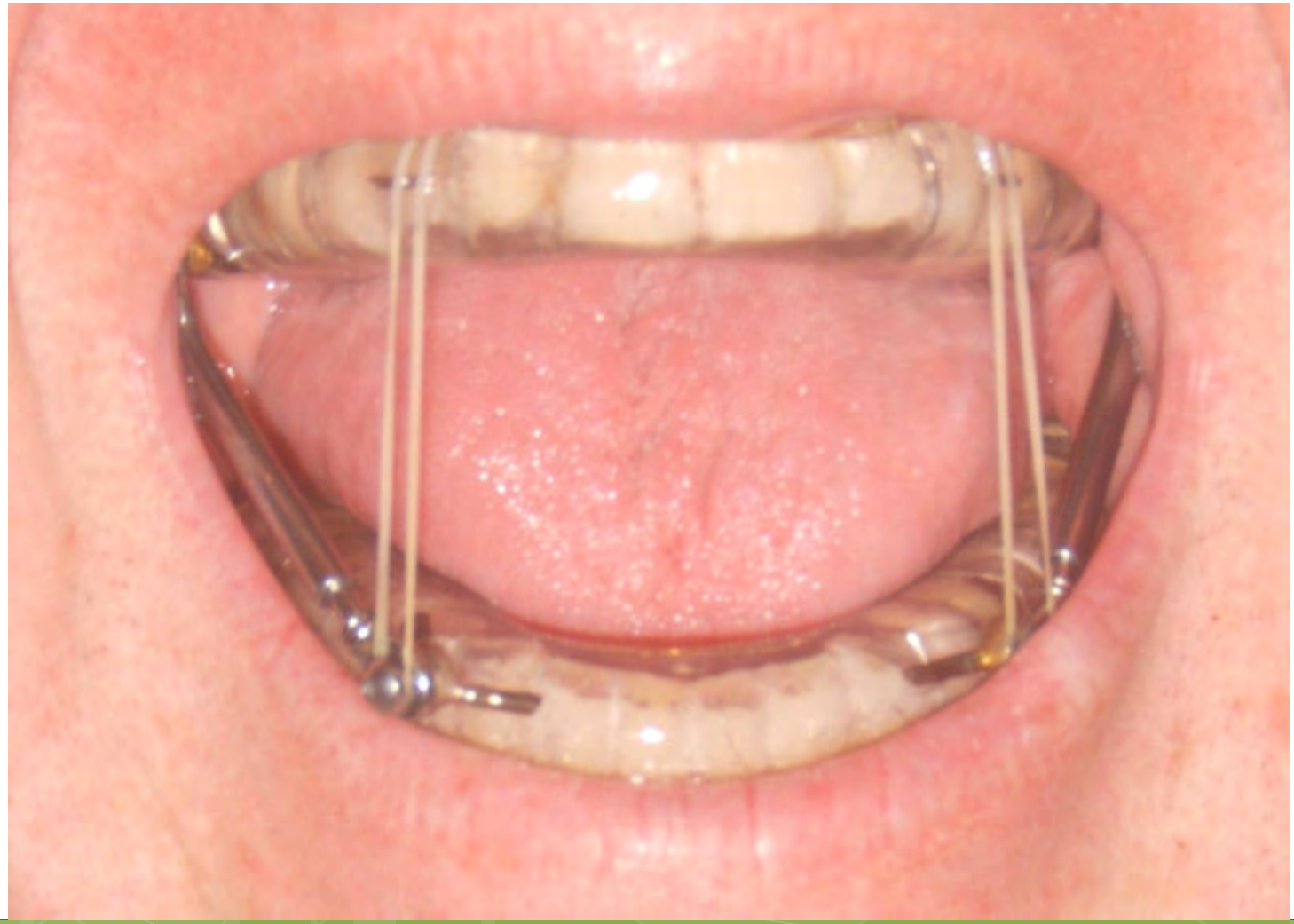
- T's and A's
- Uvulopalatopharyngoplasty
- Mandibular advancement

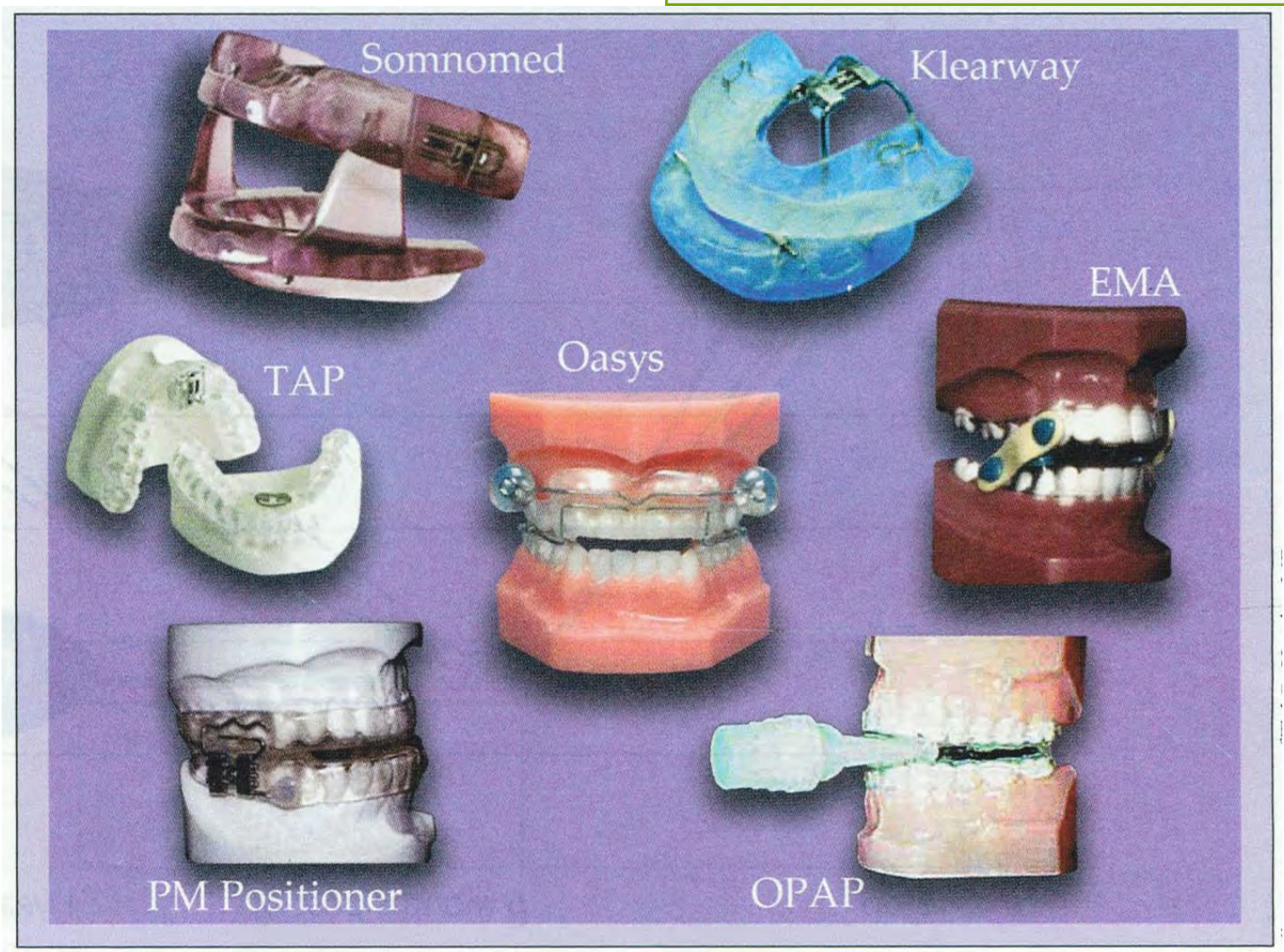
Experimental - Neuromuscular stimulation

CPAP

- EBM – severe OSA
- But even UARS feel better
- Reverses
  - Airway edema
  - metabolic syndrome
  - CV dysfunction

Mandibular advancement device




Somnomed
Klearway
EMA
TAP
Oasys
PM Positioner
OPAP

Perioperative factors

- Anesthesia agents:
  - decrease pharyngeal tone
  - Depress ventilatory response to:
    - Hypoxia
    - hypercapnia
- Disruption of sleep architecture

  1st 3 days post op
- REM rebound
- Increased apnea risk up to a week

Case

63 yr old lady for knee arthroscopy in ASC

PMH:

HTN, Obesity, GERD, OSA dx 4 months ago, not using CPAP

PSH:

Lap chole 2 years ago "difficulty waking up"

Meds:

Omeprazole, Atenolol, thiazide

Exam:

BMI 37, BP 140/90 P 65. No cardiac failure. Non-remarkable.

Airway: MP 3, FROM, 'thick neck', no dental work/loose teeth.

Pre-operative management

1) CPAP start or reinforce compliance to decrease:
   - airway edema
   - reduce blood pressure variability
   - LV strain
   - Arrhythmias

Bring CPAP day of surgery

2) Undiagnosed: suspected moderate to severe OSA with comorbidities:
   - consider referral for sleep consult/PSG

3) Further testing
   - ECHO is concern for pulmonary hypertension

4) Timing – book early for longer post-op monitoring

5) Location – appropriate for free standing ambulatory surgi-center?
   - Assess this risk – sleep apnea score out of total of 6.

Clinical Impression – severity of OSA

(Results of sleep study trump clinical impression.)

Signs/Symptoms (No sleep study)	**OSA severity**	**AHI** (PSG)	**OSA severity Score**
Borderline	Mild	5-15	1
Definite	Moderate	15-30	2
Extreme	Severe	>30	3

Choose the higher of these 2 scores and add to OSA severity score.

Post op Opiate need	Surgical Invasiveness
0 = None	0 = None
1 = Low dose oral	1 = Superficial
2 = High Dose oral	2 = Peripheral/GA
3 = Parenteral/neuroaxial	3 = Airway/major/abd

ASA practice advisory 2006

- > 4 OSA score very high risk
- OSA score of 4 = high risk
  - Decisions: individualized case by case
- Main hospital:
  - OSA 5&6
  - T's <3 yrs age,
  - UPPP,
  - upper abdominal laparoscopy
- Anesthesia plan
- Post op monitoring (book early)

Our patient

- General Anesthesia (2)
- Severe OSA (3)
- OSA score of 5 (no CPAP use)
  - CPAP use (? subtract 1 from OSA score)
- Main OR
- Book early
- Encourage CPAP compliance
- Consider block/regional

Help

Intra-operative management

GERD

difficult mask ventilation

- Opiate sparing premed
- Pre-oxygenation
- Difficult Airway
- Local/regional
- Minimize sedation
- Short acting anesthetic medications
- Multimodal analgesia
- Awake extubation / to CPAP
- (invasive monitoring as indicated for pulmonary hypertension/cardiac disease)

Minimize opiates

Post-operative management

- Elevate head of bed
- O_2 sats monitor
- CPAP
- High flow nasal cannulae
- Longer post-op monitoring in non-stimulating environment (ASA practice advisory)
  - *3 hours more than regular patient*
  - *7 hours more if an episode of O_2 desat*
- Overnight admission / monitored bed for high risk
- Follow up in sleep clinic for undiagnosed patients

OSA

- Drug sensitivity
  - Sedatives
  - Opiates
  - Neuromuscular blockers
    - Decreased arousals. Sleep disturbances increased after surgery
- Regional/local

OSA

- High index of suspicion
- Perioperative morbidity
- Cost of sleep evaluation:
  - Efficiency/delay/ease of appts
  - Pt satisfaction

  ($110 000 in 1st year
  - = 10% of death suit settlement
  - = 1% of brain injury settlement)

OSA practical points

- Review STOP BA(N)G
- If 2 or more positive in STOP, convey info to chart
- Book early for ambulatory cases
- Consider local or regional block
- Get PSG for chart if it will change management (Move to Main OR/ post op monitored bed)