

Obstructive Sleep Apnea (OSA)

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Snoring&OSA

- About 1/4 adult males snore
- Prevalence rising with increasing age
- At age of 30 y ,20% of men & 5%of women snore
- At age of 60 y 60% of males and 40% of female snore
- 25%of adult men and 9%of adult women aged 20-60 have OSA
- Despite its prevalence 85% of pts of OSA remain undiagnosed
- not all people who snore have OSA**
- all pts who have OSA are snorers**
- The snoring can also disrupt sleep in people nearby the snorer (snoring spouse syndrome) affect 20% of women in USA
- The noise level of snoring (about 90 db) is similar to screaming child ,a passing motorcycle ,or a passing subway train

Sleep Physiology

- Sleep is a reversible physiologic state manifests as a decrease awareness of reaction to external stimuli
- Normal sleep is comprised of 2 phases:
 - 1) NREM (non rapid eye movement) sleep comprise 75-80% of sleep & occurs in 4 stages(I-IV)
 - 2) REM (rapid eye movement) sleep comprise 20-25% of sleep & occurs in 2 stages
- In the normal adult these 2 types of sleep occur in semicircular cycles last 90-120m & repeated 3-4 times/night

Normal sleep

Sleep disorders






SLEEP ARCHITECTURE

- Normal sleep is **controlled by the reticular activating system** in the upper brain stem and diencephalon.
- During overnight sleep, a series of **repeated cycles** of EEG patterns can be recorded . Each cycle lasting **90 to 120 minutes** each.
- **Four to five such cycles occur** during a typical night of sleep. During the first half of the night, the individual typically passes from wakefulness briefly into stage 1 sleep and then to stages 2, 3, and 4.
- Stages 3 and 2 reappear, after which REM sleep is observed for the first time.
- **During the second half of the night, stage 2 and REM sleep alternate.**

REM sleep

- **Dreaming takes place during REM sleep.**
- This is accompanied by muscle relaxation, penile erection and loss of tendon reflexes.
- REM sleep seems to be the **most important part of the sleep cycle** for refreshing cognitive processes. some data suggest an important role for REM sleep in **memory consolidation** .
- **Deprivation of REM sleep causes tiredness, irritability and impaired judgement.**
- Abnormalities in REM sleep are thought to be the cause of narcolepsy.

Hemodynamic and ventilatory changes during normal sleep

	NREM	Tonic REM	Phasic REM
Blood pressure	Decreases	Decreases	Increases  Sudden Increases In Arterial BP
Heart rate	Decreases	Decreases	Increases  arrhythmias
Vessel size	Vasodilatation	Vasodilatation	Vasoconstriction  cardiac or cerebral ischemia
Cerebral blood flow	Variable	Increases	Further increases 
Respiratory rate	Decreases	Decreases	Increases
Minute ventilation	Decreases	Variable	Variable
Ventilatory responses to hypercapnia	Intact	Intact	Impaired
Respiratory muscle tone	No change/small decrease	Intercostals atonic, upper airway muscles hypotonic, diaphragm tonic	Diaphragm transiently inhibited, other respiratory muscles atonic or hypotonic
Airway smooth muscle	Decreases	Decreases	Increases 
Arousal response	Faster than in REM	Slower than in NREM	Slower than in NREM

predominantly
parasympathetic
(vagal) state

sudden bursts of
sympathetic nervous
system (SNS) activity
associated with rem

Definition :

- S.A is a disorder of intermittent cessation of airflow by nose or mouth during sleep for at least of 10 seconds at a time.
- Diagnosed during 7 hours of nocturnal sleep > 5 Apnea / hour.

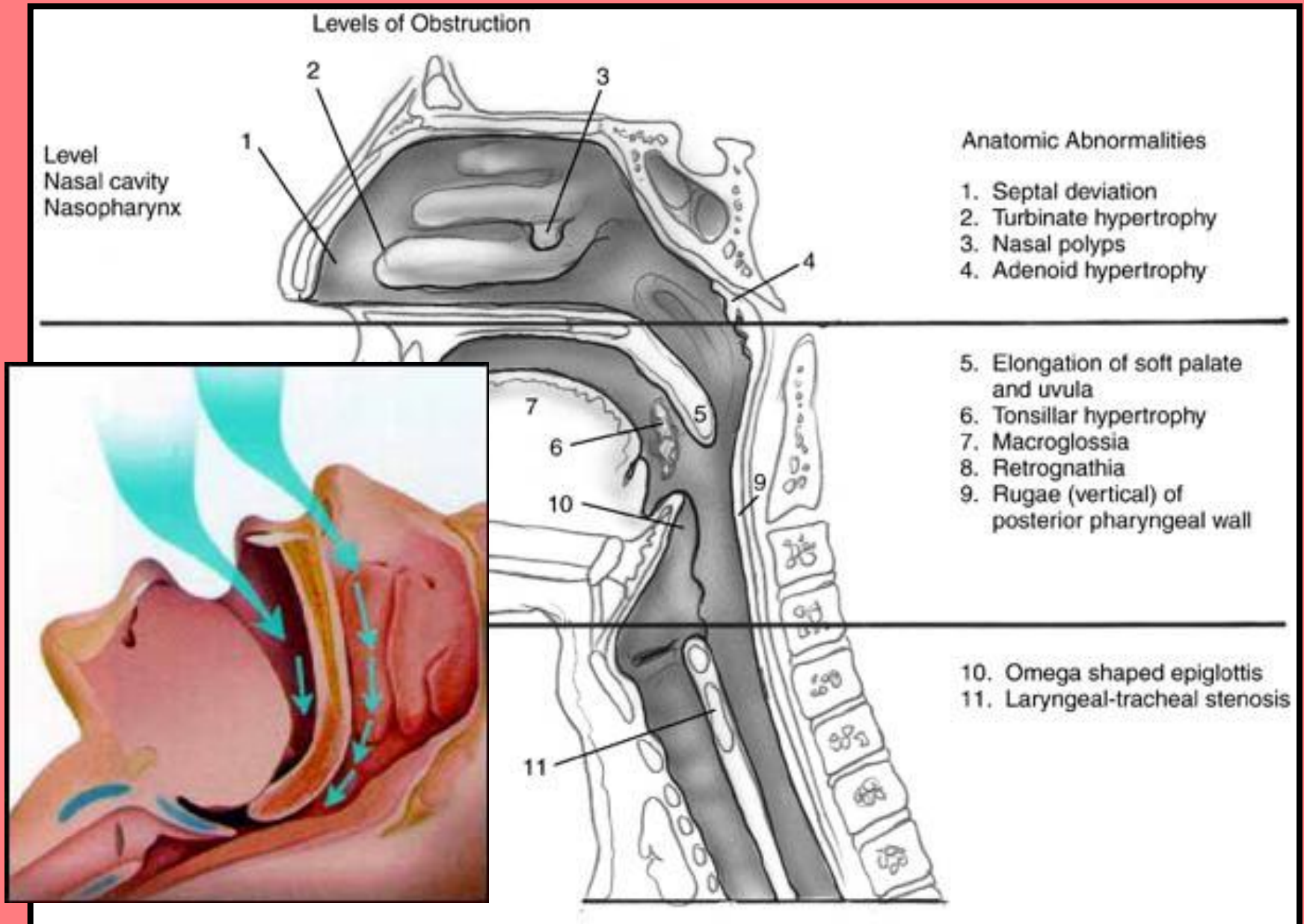
Classification :

- OSA : No airflow despite persistent respiratory effort with paradoxal movement of the chest and abdomen in attempt to overcome the upper airway obstruction.
- CSA : No respiratory movement the cessation in airflow is due to transient lack of respiratory effort. The phrenic nerve and diaphragm are temporarily inactive due to intermittent failure in the respiratory drive center of CNS.

Classification : Cont...

- **Mixed SA** : Considered as variant of OSA initially no airflow or respiratory effort but after an interval respiratory effort is resumed and re-established airflow.
 - * OSA is the most common type of apnea ,OSA often involves the ORL care.
 - * Treatment of MSA is similar to that of OSA.
 - * Central apnea is generally treated by neurologists and sleep specialist.

Pathophysiology...



Pathophysiology of OSA:

- Pharyngeal collapse in patient whom there is already some degree of obstruction in airway.
- ↓ pharyngeal muscle tone during REM precipitate collapse of an already narrowed pharyngeal airway at the results of venturi effect → ↓ PaO₂ → ↑ PaCO₂ → increasing muscle tone.

Etiology:

a. OSA in children usually due to adenoids + tonsils hypertrophy.

Other causes in children

- Nasopharyngeal cysts
- Encephaloceles
- Choanal atresia
- DNS
- Craniofacial or orthodontic malformation

Etiology:

b. Adult

* Enlargement of soft palate :

- Fatty deposition
- Age: with increasing age the mucosa of the palate ,oropharynx ,and hypopharynx becomes less elastic and more collapsible with inspiration
- Hormonal factors
- Muscular relaxation

Etiology

* Other factors

- **Obesity** : increase fat in Parapharyngeal space that narrows the pharynx, redundancy in the soft palate and fullness in the tongue
(neck size >17 in Males Or >15 inches in Females or body mass >27kg/m² or both)
- **Tongue enlargement**
- **Alcohol**
- **Micrognathia**

Epidemiology...

TABLE 4. RISK FACTORS FOR OBSTRUCTIVE SLEEP APNEA

Obesity

Specific craniofacial disorders (e.g., Treacher-Collins, Pierre-Robin syndromes)

Retroposed mandible/maxillae

Adenotonsillar hypertrophy

Nasal problems: septal deviation, allergic rhinitis

Endocrine abnormalities: hypothyroidism/acromegaly

Polycystic ovarian syndrome

Postmenopause

Down syndrome

Family aggregation

APOε4 allele (in subjects < 65 yr)

Symptoms:

a. Night time Symptoms :

- Snoring ++
- Breathing pauses
- Difficulty of breathing while sleeping
- Mouth breathing
- Frequent nocturnal urination (nocturia)
- Coughing or choking
- Restless sleep
- Sleeping in unusual position
- Sweating
- In children:
 - *Bed wetting
 - *ADHD (attention-deficit/hyperactivity disorder)
 - * Growth delay

Symptoms:

b. Day time symptoms.

- Appearing sleepy during the day
- Appearing hyperactive during the day
- Day time behavior prob. irritability easily frustrated
- Falling asleep at inappropriate time (while meal time, while driving that may cause traffic accident)
- Morning headache
- Difficulty in school poor performance children may be labeled as 'slow' or 'lazy'
- Change in personality (depression)
- Depression, anxiety, concentration loss
- Reduced libido.



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CARDIOVASCULAR Complications

of S.A :

- Hypertension, arrhythmias (arterial fibrillation, ventricular arrhythmias)
- Atherosclerosis (heart attacks, angina, stroke)
- Congestive Heart failure
- Chronic respiratory failure
- Sudden death

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Evaluation...



- History

Daytime Symptoms:

- Physical Examination
- Sleep Hygiene

- Investigational Signs
- 1. Morning Headache
- Epworth Sleepiness Scale
- 2. Excessive Daytime Sleepiness
- Use of Meds/Alcohol/Caffeine

- 3. Complete History of Mouth & Nose
- 3. Cognitive Impairment
- 4. Examination
- 4. Impotency
- Nasopharyngeal



The Epworth Sleepiness Scale

- The Epworth Sleepiness Scale is widely used in the field of sleep medicine as a subjective measure of a
- patient's sleepiness. The test is a list of eight situations in which you rate your tendency to become
- sleepy on a scale of 0, no chance of dozing, to 3, high chance of dozing. When you finish the test, add
- up the values of your responses. Your total score is based on a scale of 0 to 24.

The scale estimates whether you are experiencing excessive sleepiness that possibly requires medical attention.

The Epworth Sleepiness Scale

- **How Sleepy Are You?**
- How likely are you to doze off or fall asleep in the following situations? You should rate your chances
- of dozing off, not just feeling tired. Even if you have not done some of these things recently try to
- determine how they would have affected you. For each situation, decide whether or not you would
- have:
 - · No chance of dozing =0
 - · Slight chance of dozing =1
 - · Moderate chance of dozing =2
 - · High chance of dozing =3
- Write down the number corresponding to your choice in the right hand column. Total your score below

The Epworth Sleepiness Scale

- **Situation Chance of Dozing**
- Sitting and reading ·
- Watching TV ·
- Sitting inactive in a public place (e.g., a theater or a meeting)
- ·
- As a passenger in a car for an hour without a break
- ·
- Lying down to rest in the afternoon when circumstances permit
- ·
- Sitting and talking to someone ·
- Sitting quietly after a lunch without alcohol ·
- In a car, while stopped for a few minutes in traffic ·
- Total Score = _____

- **Interpretation:**
- **0-7:**It is unlikely that you are abnormally sleepy.
- **8-9:**You have an average amount of daytime sleepiness.
- **10-15:**You may be excessively sleepy depending on the situation. You may want to consider seeking medical attention.
- **16-24:**You are excessively sleepy and should consider seeking medical attention.

Clinical Examination :

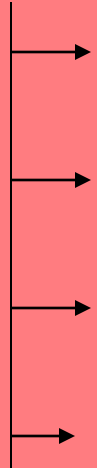
- Complete head and neck examination

- Nose R/O DNS



- Hypertrophied turbinate
- Allergic rhinitis

- Oral cavity



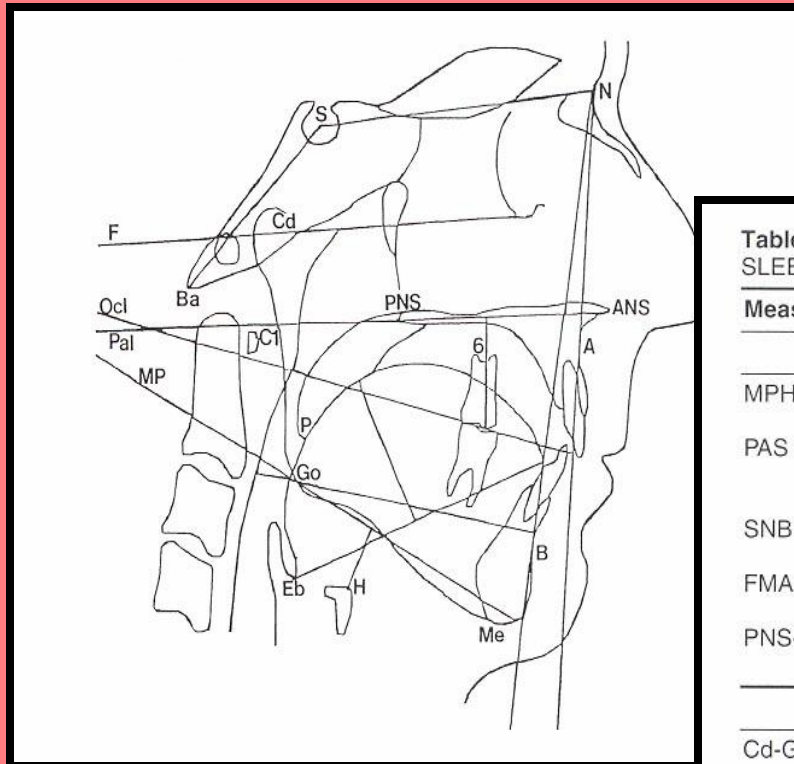
- R/o tonsils hypertrophy
- Redundant soft palate+ uvula
- + Lateral pharyngeal wall
- Retrognathia
- Macroglossia

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Clinical Examination Cont....

- Larynx R/o obstructing lesion
- Thick + short neck : may predispose patient to OSA (Pick Wickian Synd.)
- Nasophyngoscopy
(MullerManoeuver)

Evaluation...



•Thyroid Func

•Cardiac Eval

Table 1. CEPHALOMETRIC MEASUREMENTS ASSOCIATED WITH OBSTRUCTIVE SLEEP APNEA

Measure	Description	Association with OSA
Most Common Measurements		
MPH	Mandibular plane to hyoid	Inferiorly positioned in OSA (Normal = 17 ± 6 mm)
PAS	Posterior airway space. Distance from pharynx to tongue measured on a line from point B to gonion	Narrow in OSA (Normal = 10 ± 3 mm)
SNB	Angle of sella to nasion to point B	Decreased in OSA (Normal = $80 \pm 4^\circ$)
FMA	Frankfort-mandibular plane angle	Increased in OSA (Normal = $24 \pm 5^\circ$)
PNS-P	Soft palate length	Increased in OSA (Normal = 42 ± 5 mm)
Other Measurements Studied		
Cd-Gn	Mandibular length (condyle to gnathion)	Decreased in OSA (Normal = 122 ± 6 mm)
PNS-ANS	Maxillary length (posterior nasal spine to anterior nasal spine)	Decreased in OSA (Normal = 88 ± 4 mm)
Tng Ht	Tongue height (perpendicular distance from tip to epiglottis base)	Increased in OSA (Normal = 39 ± 8 mm)
ANS-N	Maxillary height (anterior nasal spine to nasion)	Increased in OSA (Normal = 57 ± 4 mm)
SNA	Sella to nasion to point A	Decreased in OSA (Normal = $83 \pm 4^\circ$)
S-N	Cranial base length (sella to nasion)	Decreased in OSA (Normal = 7.5 ± 3 mm)
N-S-Ba	Cranial base angle (Nasion to sella to basion)	Acute in OSA (Normal = $129 \pm 5^\circ$)

Data from Johns FR, Sandler NA, Braun TW: Management of obstructive sleep apnea. Selected readings in Oral and Maxillofacial Surgery, Volume 5, Number 3, 1993.

Investigation :

- **ECG**
- **O₂ saturation**
- **PNS**
- **CXR : R/O cardiopathy + Rt heart failure**
- **Neck soft tissue X-ray**
- **Nasopharynx x-ray**
- **CT - not routinely.**

Sleep Study +++ Comport :

a. History - we ask patient.

1. Does your snoring ever awaken you from sleep.
2. Do you ever awaken suddenly, gasping for air.
3. Do family members complain of your snoring
4. Does your spouse notice periods in which breathing temporarily stops
5. Do you feel rested after a night sleep.
6. Do you feel drowsy at work, or do you fall asleep at inappropriate times (work, while driving, or telephone).

Sleep Study +++ Comport :

b. Polysmmography

- The most sensitive and specific test in evaluation of OSA.
- It measures
 - Brain activity
 - Leg muscle movement
 - Cardiac rhythm
 - Eye movement

Sleep Study +++ Comport : Cont...

- **Pulse oximetry**
- **Respiratory effort**
- **Air movement at the nose and mouth.**
 - * **This test can differentiate between snoring without OSA, pure OSA, CSA.**
 - * **It characterize the severity of apnea.**
 - * **This test is expensive and require the patient to spend a night in a formal sleep bed.**

Sleep Study +++ Comport :

c. The multiple sleep latency test (MSLT)

- Perform in a sleep bed
- During day time
- This test assesses the time it take for the subject to fall asleep.
- An average < 5 minutes is generally considered pathologic, and suggest excessive OSA.

Sleep Study +++ Comport :

d. Home sleep study

- Recently implemented to reduce the cost.
- This slowly range from simple continuous pulse oximetry recording to multi channel recording devices similar to those used in a formal sleep study.

Sleep Study +++ Comport :

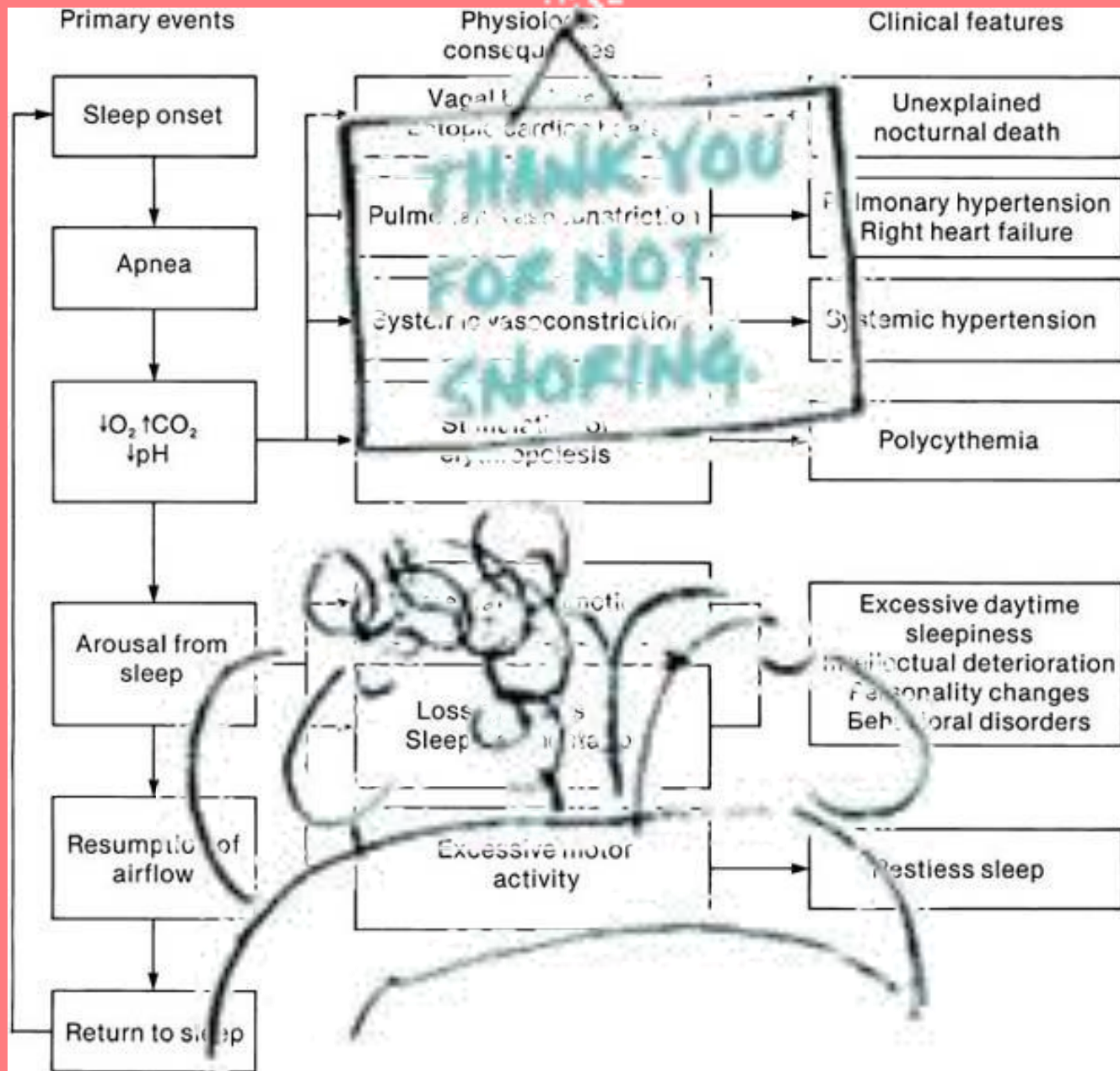
e. Evaluate of severity

- Several parameters can be used to classify the severity of OSA.
- The most common of which is the respirators disturbance index (RDI).
- This the sum of the number of apneas (cessation of airflow for > 10 sec.) and hypopneas (reduction of air flow by 50%) per flow.

- The degree of oxyhemoglobin desaturation can also be useful

	RDI	SaO₂
Mild OSA	5- 15	
Moderate OSA	15- 30	< 85%
Sever OSA	> 30	< 60%

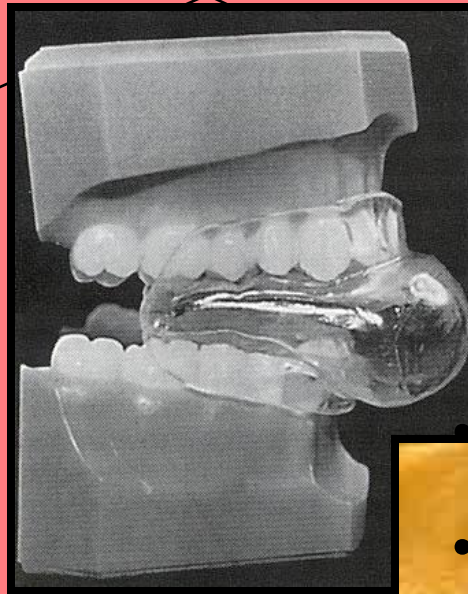
Rationale For Treatment...



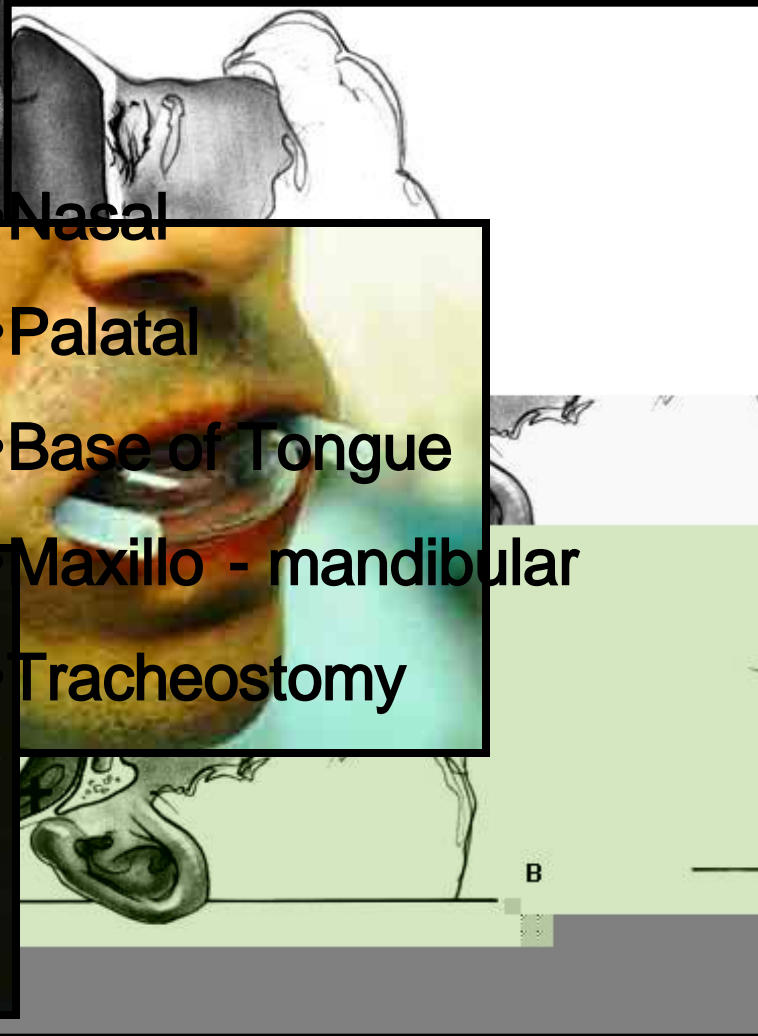
Treatment...

Conservative

- Weight Loss
- Sleep Hygiene
- CPAP/BiPAP
- Oral Appliances



- Nasal
- Palatal
- Base of Tongue
- Maxillo - mandibular
- Tracheostomy



Treatment :

Childhood

- **AD tonsillectomy ++**
- **CPAP (Continuous Positive Airway Pressure)**
a mask is worn over the nose during sleep and pressure from an air compressor forces air through nasal passage and into the airway.
- **This pressure keep the airway open and allows the child to breath normally.**





Adult

- **Mild OSA**
 - **Behaviors changes**
 - ↓ **Weight**
 - **Abdominal sleep or side sleep +++++**
 - ↓ **Alcohol in night period**
 - **Raising the head of the bed**
- **Moderate : treated by C-PAP.**
- **Moderate-sever (Bi-POP) machine blow air at two different pressure when a person inhales the pressure is higher and in exhaling the pressure is lower.**

Treatment :

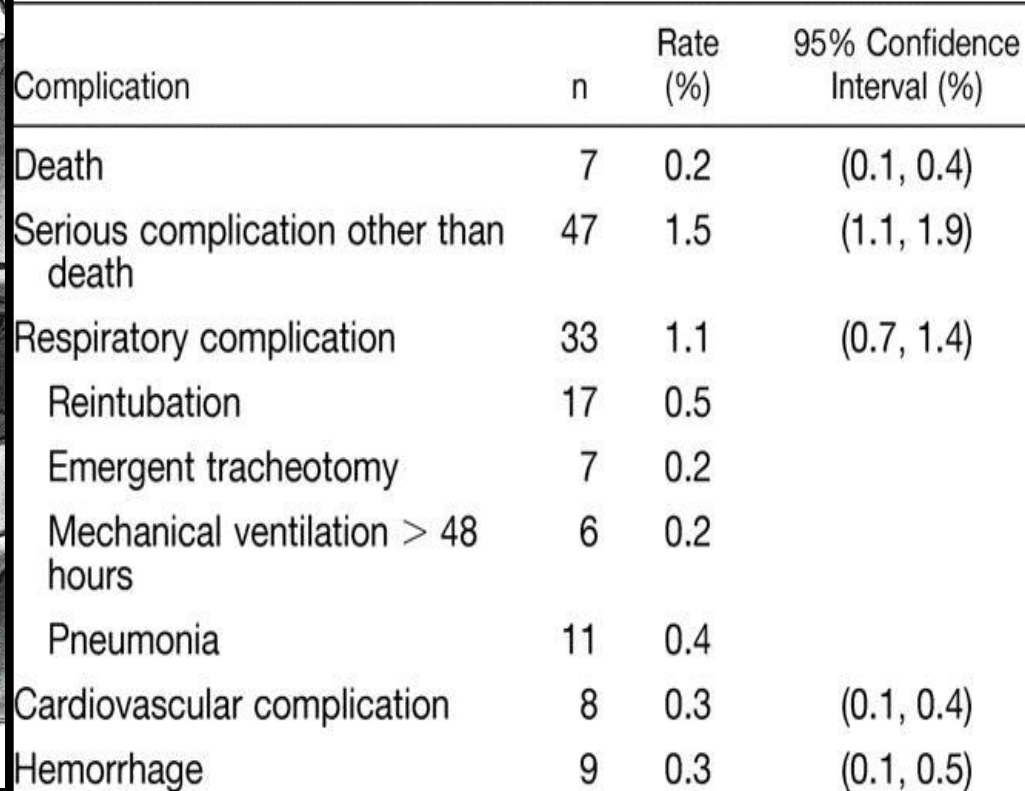
Severe OSA

- Tracheostomy
- UPPP (Uvulo Palato Pharyngoplasty) 50% good results
- Mandibular myotomy to pulls the tongue forward 6 – 12mm.
- LAUP (Laser Assisted Uvulo Plasty) .
- Radio frequency (RF) procedure or smonoplasty
This is the newest surgical procedure for snoring and SA approve by FDA in USA.

Surgical Treatment...

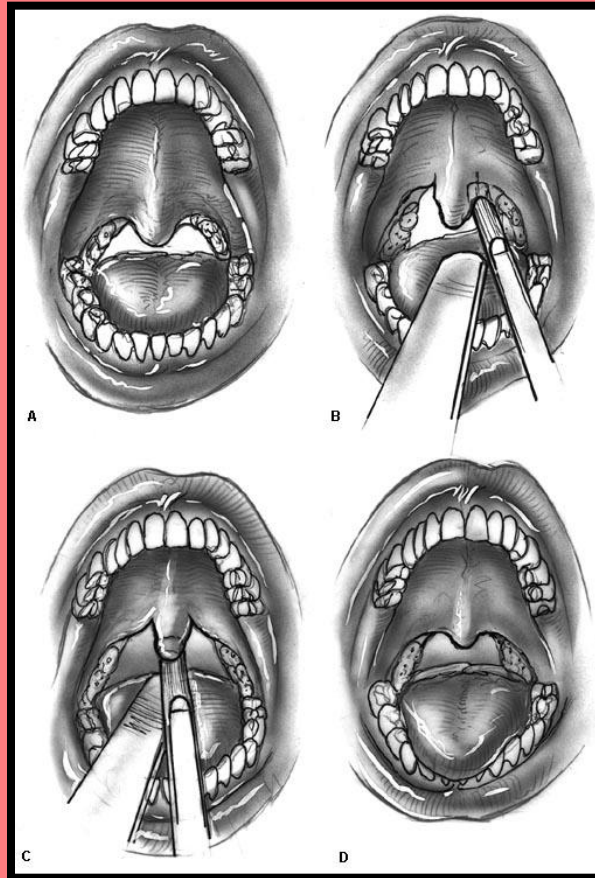
Uvulopalatopharyngoplasty

TABLE III.
Incidence of Serious Complications and Death in
Uvulopalatopharyngoplasty Cohort (n = 3,130).



Complication	n	Rate (%)	95% Confidence Interval (%)
Death	7	0.2	(0.1, 0.4)
Serious complication other than death	47	1.5	(1.1, 1.9)
Respiratory complication	33	1.1	(0.7, 1.4)
Reintubation	17	0.5	
Emergent tracheotomy	7	0.2	
Mechanical ventilation > 48 hours	6	0.2	
Pneumonia	11	0.4	
Cardiovascular complication	8	0.3	(0.1, 0.4)
Hemorrhage	9	0.3	(0.1, 0.5)

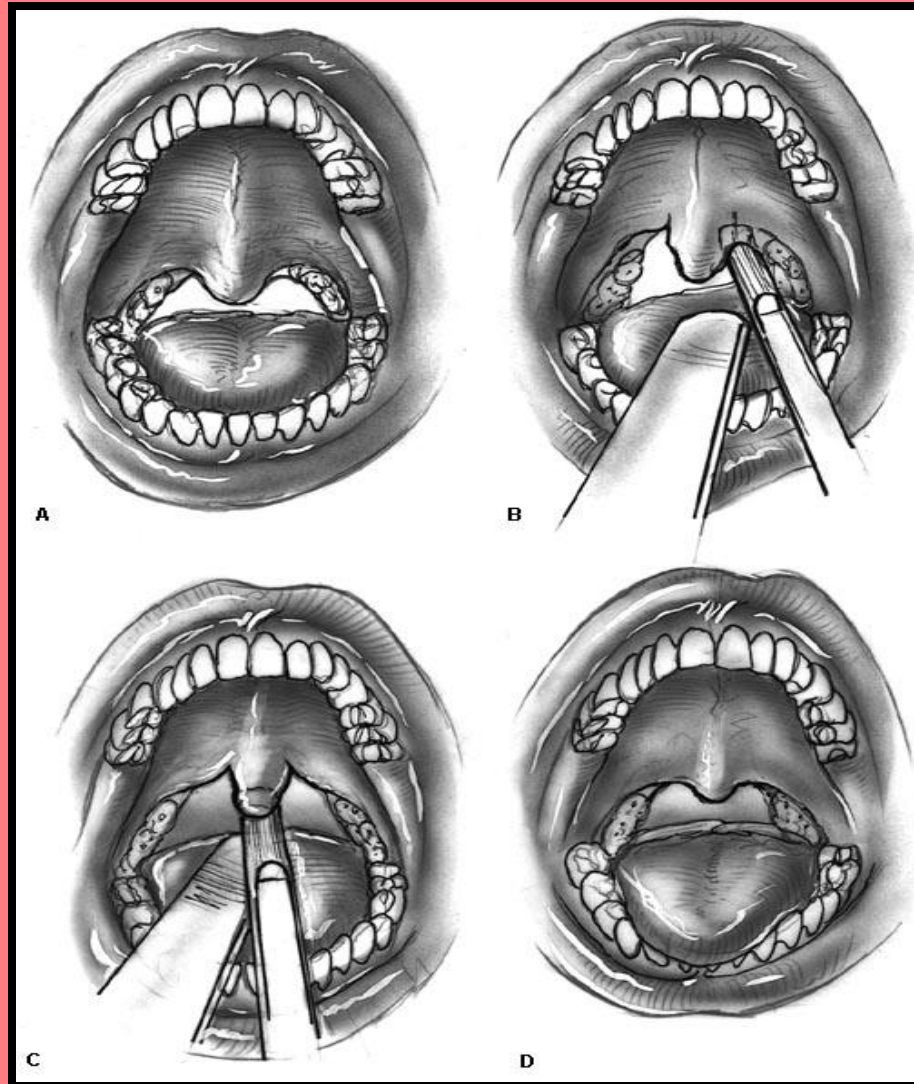
Some patients experienced more than one complication.



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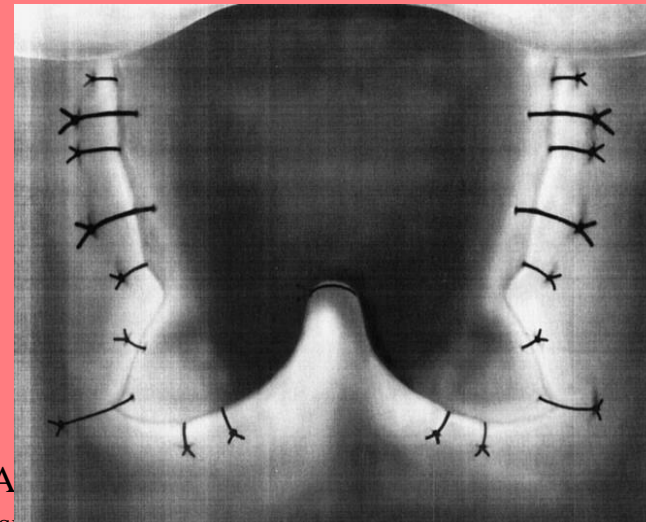
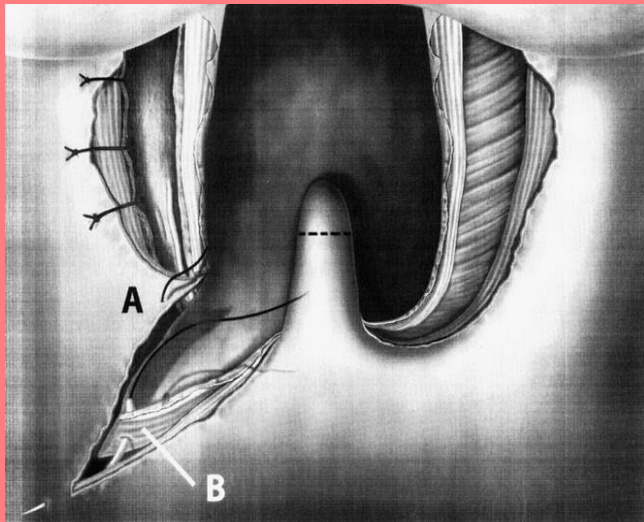
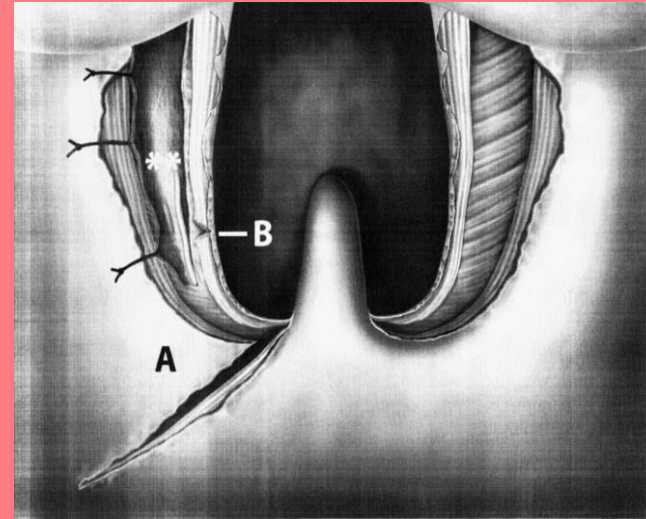
Surgical Treatment...

LAUP



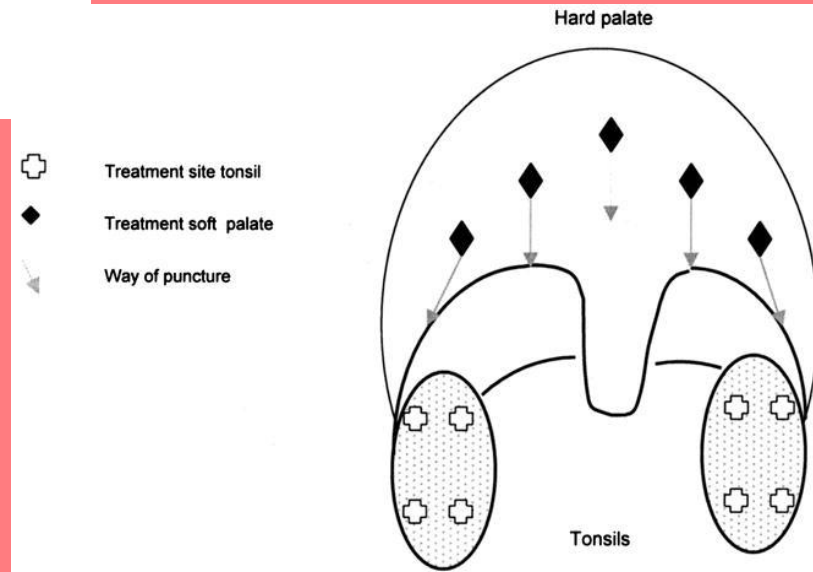
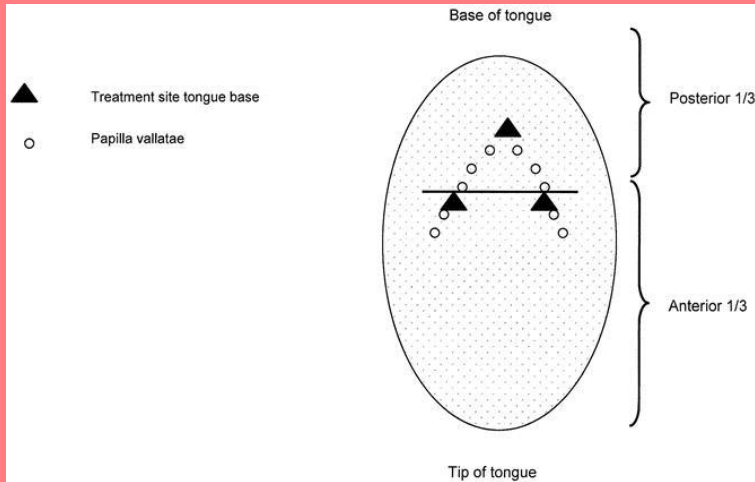
Surgical Treatment...

Lateral Pharyngoplasty



Surgical Treatment...

Radiofrequency Ablation

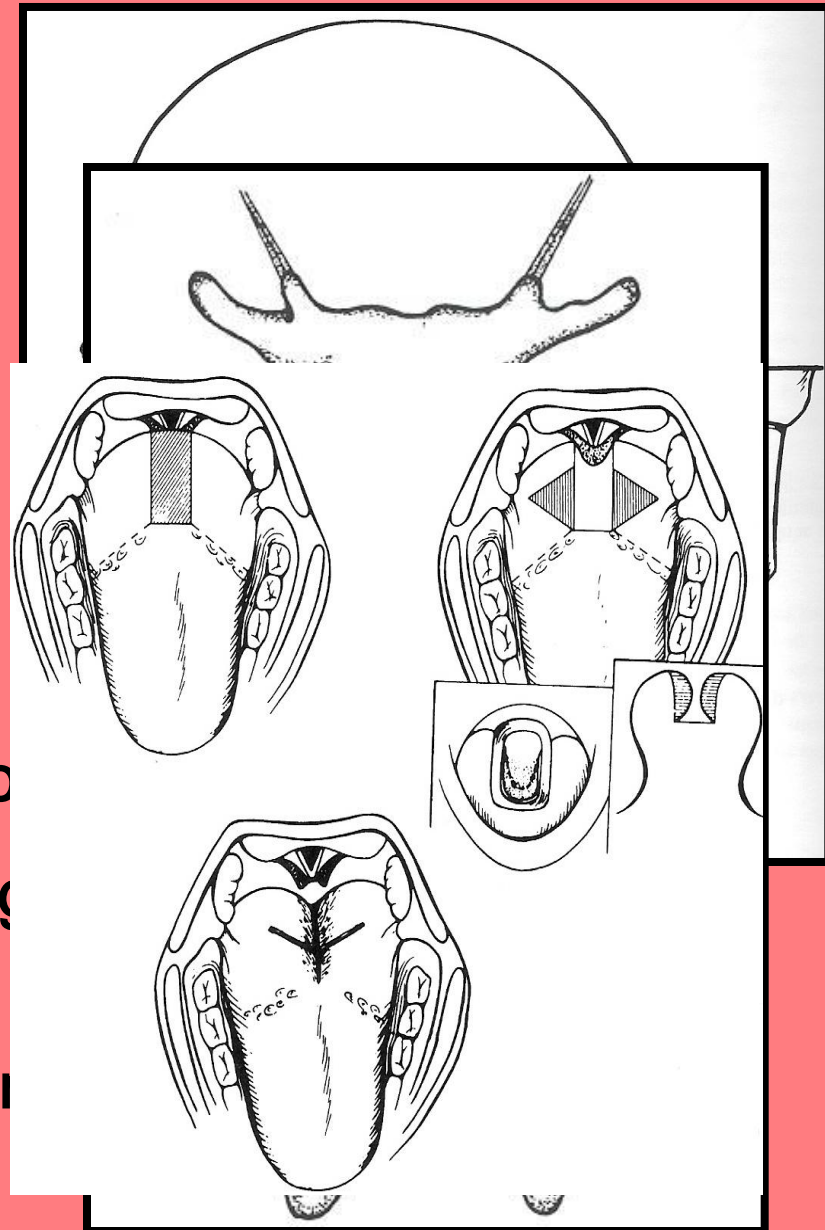


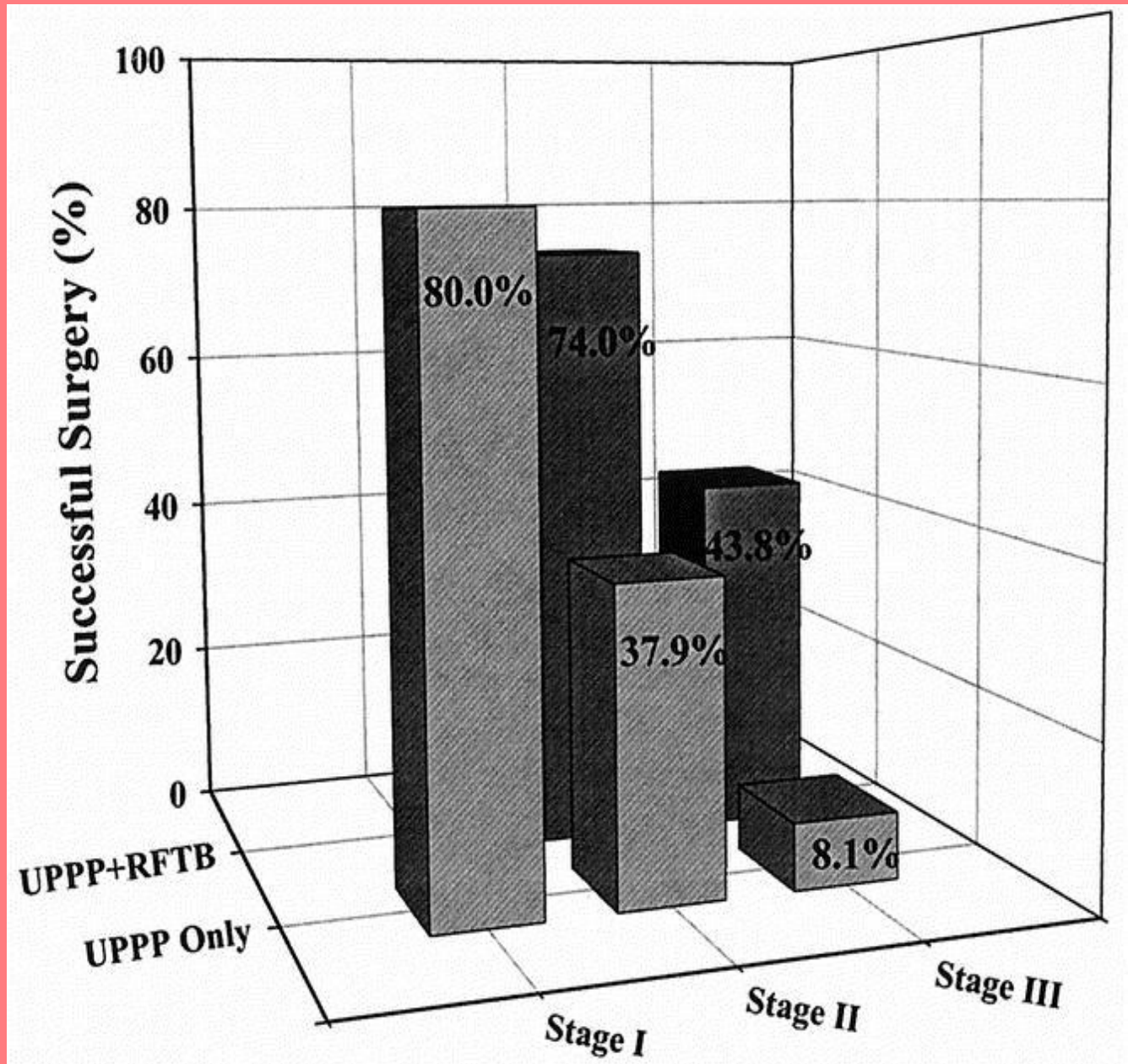
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Surgical Treatment...

Tongue Base Procedures

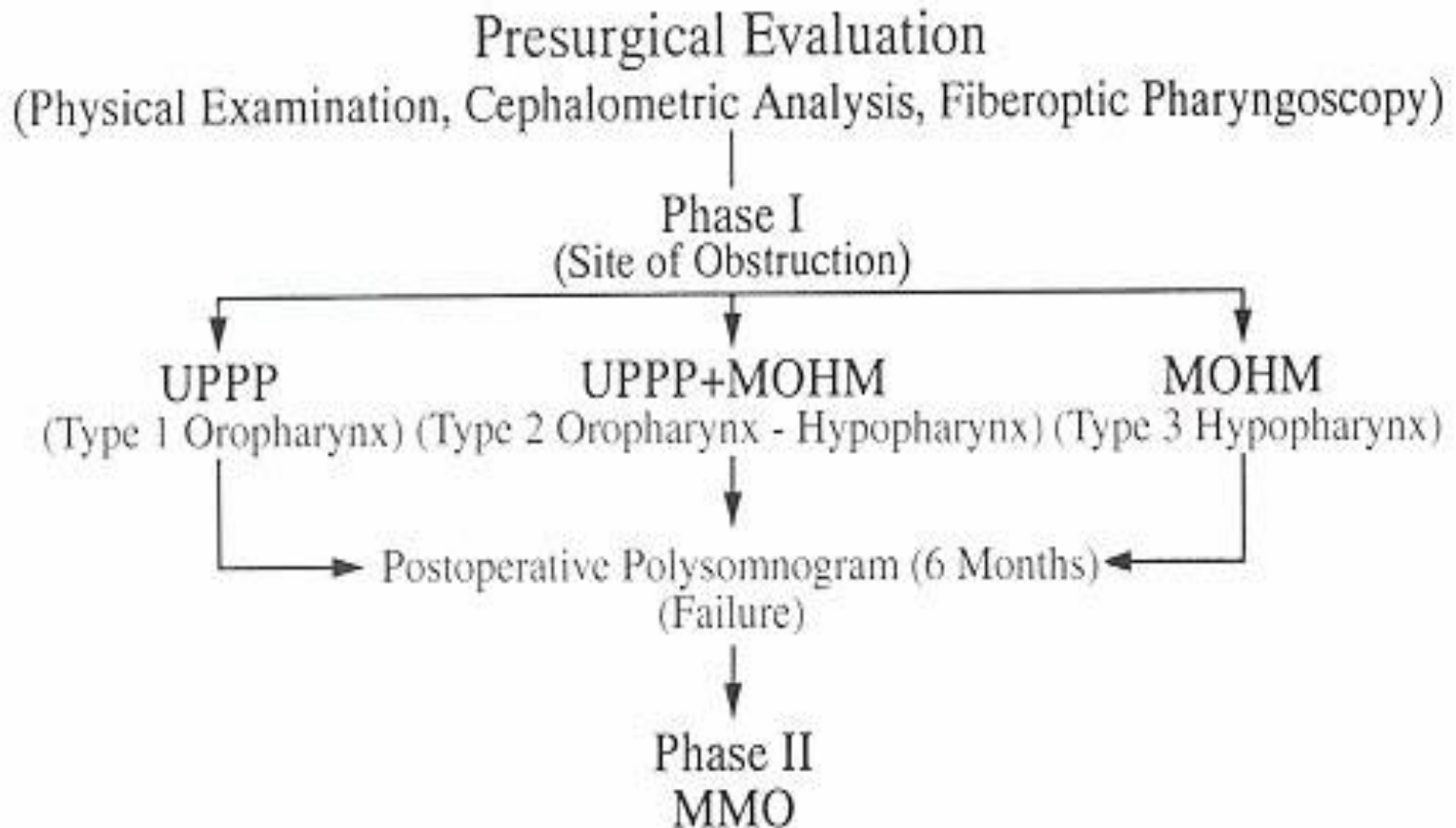
- Lingual Tonsillectomy
- Lingualplasty
- Tongue suspension
- RF volumetric tissue reduction
- Mandibular osteotomy/genioglossus advancement
- Hyoid myotomy & suspension



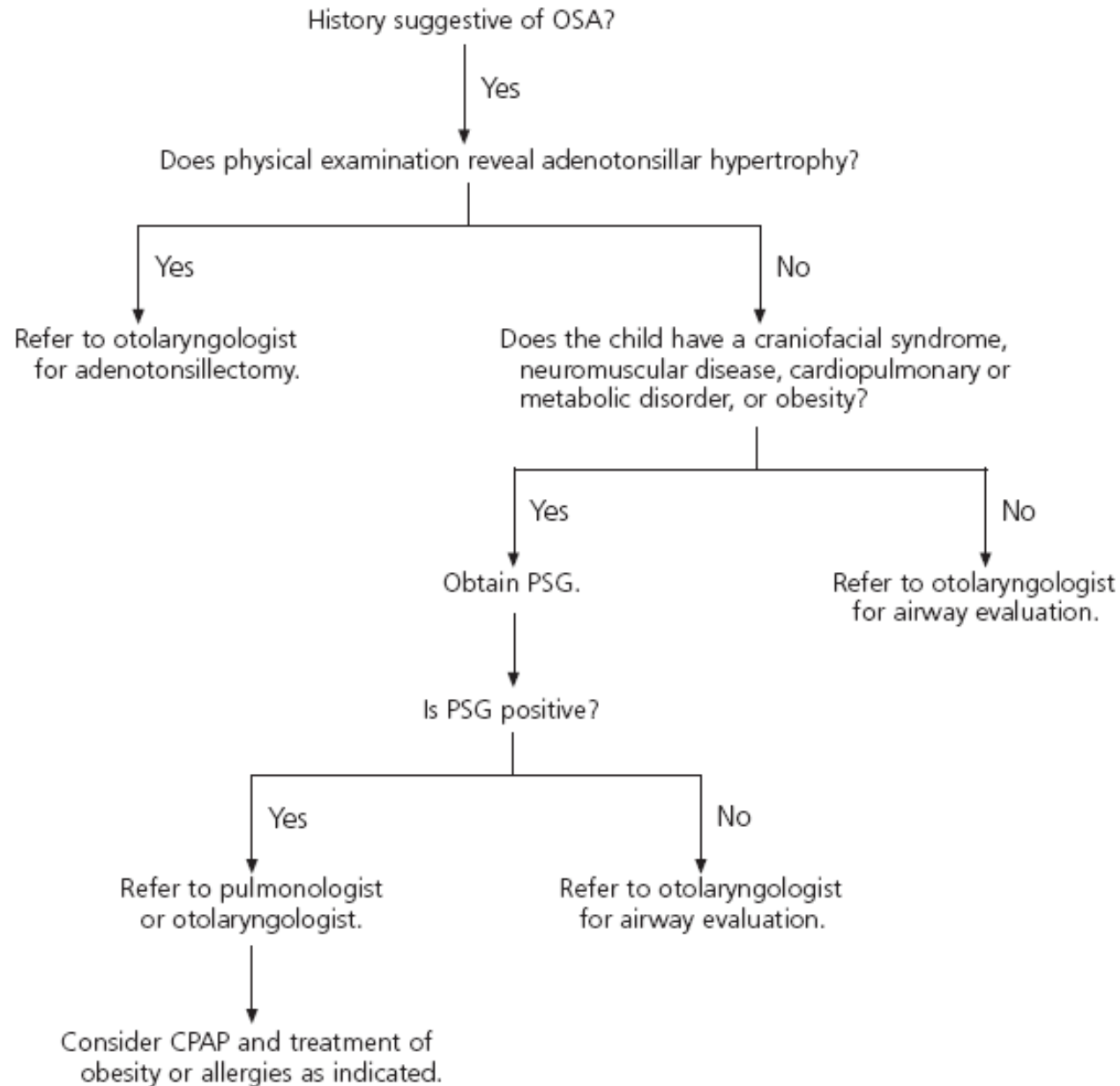


Algorithms...

Riley-Powell-Stanford Protocol



Management of OSA in Children



Treatment : Cont...

- For snoring the procedure is called radio- frequency volumetric tissue reduction of the palate.
- For OSA the procedure called radio-frequency volumetric reduction of the tongue.
- This procedures involves percings the tongue, soft palate,throat by electrode connected to & radio frequency generator the inner tissue is heated to 158 – 176 degrees so inner tissues shrink, outer tissues which contain taste buds left intact.

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**Getting enough sleep helps you
do your best in whatever you do.**

A close-up photograph of a field of vibrant red tulips. The flowers are in various stages of bloom, with some in sharp focus and others blurred in the background. The green stems and leaves are visible at the bottom. Overlaid on the center of the image is the text "Thank You" in a large, bold, yellow font with a black outline and a fine dotted pattern. The text is slightly slanted upwards from left to right.

Thank You