The Protocol for the Diagnosis of Obstructive Sleep Apnea Syndrome

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Our understanding of the nature and the sequence of upper airway obstruction has evolved gradually but considerably. This obstruction, occurring repeatedly in sleep along with daytime sleepiness is called Sleep Apnea Syndrome. Narrowing or closures may occur at one or more sites in an unstable upper airway. The upper airway size is determined by soft-tissue and skeletal factors, that are also major determinants of upper airway patency during sleep. The presence of certain physical characteristics should strengthen the surgeons suspicion of some dysfunction during sleep. There are various methods of identifying the physical attributes in patient of Sleep Apnea. The measurement of all the characters plus the sleep study, helps the surgeon eventually to select the site needing immediate treatment. This will not only straighten the upper airway but also prevent any re-occurrences, which is very common if the patient is not properly evaluated. Great stress should be laid on presurgical protocol, an

alternative for more appropriate diagnosis and treatment.

INTRODUCTION

When the upper airway is obstructed due to Physiological or Anatomical (bony or soft tissue) cause, it results into a chain of events, which culminate into an entity called Sleep Apnea Syndrome. (Orr, 1983). This disorder primarily presented to Chest Physicians as a derangement of breathing pattern, which later interested the ENT Surgeon because patients started being referred to him to find out the cause. This disorder over the years has attracted a lot of Surgeons over the world and lot of work has been done to understand it and to treat it (Rofwarg, 1979). Treatment of this disorder is difficult as the causes are not very well known. It becomes very important to know the cause as the treatment failure can worsen the condition. It is very important for the ENT Surgeon to get a feel of as to how to arrive to a definite diagnosis, both of

FIGURE 1

Figure Showing the Protocol followed in the diagnosis and treatment of OSAS patients

the disease and the cause. (Fujita, 1981). The whole drill involves a set of rigid pattern, which has to be adhered to, so as not to miss any point (Sher, 1990).

MATERIALS AND METHODS

400 patients have been seen at the ENT Department of Safdarjang Hospital, which were referred to the author for evaluation and treatment. A definite protocol was developed to examine these patients and thus decide their treatment policy. The authors wish to share their protocol with other ENT Surgeons and describe their way of arriving at a diagnosis of OSAS. The presentation of data and distribution is beyond the scope of this article and will be described elsewhere. The article will only concentrate on the methods applied and their execution (Fig.1).

METHODOLOGY

The most important aim of this examination is to pin point the level of obstruction, as this disorder involves multiple level involvement. If anyone

is interested in this field then there is a need to develop a proper protocol so as to have uniformity in patient selection and treatment (Fujita, 1994).

A. Patient selection

1. Referral from a well developed Sleep Center.
2. Directly from the ENT OPD.
3. Directly referred to the OPD from other department or hospitals.

From our experience there is need to tell everyone that such facilities are available in the present set up or there should be a well-developed Sleep Center. Information about the existence of such facility should be made available to all clinicians who are concerned with this disorder e.g. Physicians, Maxillo Facial Surgeons, Radiologists, Endocrinologists, Anaesthetists etc.

B. ENT Examination

1. General Morphological Examination
2. Local Examination (Table I)
3. Fibroptic Endoscopy (Table III)
4. Cephalometry (Table II)
5. Special tests like Polysomnography, Blood Gas Analysis, Pulmonary Function Tests etc.

GENERAL MORPHOLOGICAL EXAMINATION

Facial Characteristics

1. Shape : Oval, Round, Pear Shaped, Normal etc.
2. Size : Empirically measured to find out whether the width of the face is more than the length of the face. Two parameters are taken into account. The Bi-Mandibular distance and the distance between the chin and the thyroid notch. This characteristic helps primarily the anaesthetist who will eventually, have to decide whether the case is an easy intubation or a difficult one. The parameters that the anaesthetists take into account are similar to these.
3. Neck Length : Essentially required for the

Fig.2

Figure showing parameters for Cephalometry

anaesthetists. Measured using a formula $a+b/2$, where 'a' is the length from the chin to the sternum and the 'b' is the length from the Basi Occiput to the nuchal prominence. Most of the OSAS patients have a short and thick neck.

1. Occlusion pattern of the mouth : Normal bite, Cross bite, Prominent upper jaw Teeth, Retrognathia. All these are also noted and help in deciding the mode of treatment.
2. Status of breathing pattern is noted by observing whether the patient is mouth breathing at rest, has noisy breathing, breathlessness etc.
3. Patients weight and height is noted and his BMI noted down (weight in Kgs/height in meter square).

Examination of the Throat (Mesopharyngometry) (Fujiwara, 1993)

Tongue : The patient is asked to open his mouth without saying Ah as this lifts the palate and contracts the tongue and thus may give false impression. No tongue depressor is used and the tongue is graded as grade I, II, III (Fujiwara, 1993). Grading depends on the percentage of fauces covered by the tongue, thus a grade III tongue means the one which hides the view of the fauces completely on mouth opening.

Soft Palate : No special grading was given to this structure as it is difficult to relate it to any fixed parameter. The palate was graded as low lying, bulky, short, thin, long etc depending actually the lie of the palate in relation to the Tonsils and the uvula depth.

Tonsils : They were graded as stated by Fujiwara on the style of Mackenzie, as grade I, II, III depending on the percentage of posterior pillars seen e.g.: grade III tonsils means it hides the view of the posterior pillars completely as they are enlarged to that extent.

Uvula : By the help of small but thin and long architect calipers the uvula is measured in its width and breadth. Similarly the distance between the two posterior pillars and the space

between the free edge of the soft palate and the posterior pharyngeal wall is also calculated. All these parameters are of academic interest and help in documentation. The measurements of the sites mentioned definitely vary in OSA patients. (Published elsewhere).

Currently in Stanford University various other parameters have been added. The size of the oral cavity is measured by taking into account the intermolar distance, distance between tongue and Hard palate etc. since the stress is on correction of hard tissue deformity in OSA patients hence the importance of these measurements.

Anterior Rhinoscopy (Olsen, 1981, Lavie, 1983): This is done the usual way and the patency of the nasal airway noted. The cavity is graded in I, II, III+ or – DNS. This is purely done to simplify the expression and bring uniformity. Grade III nose is the one with all three turbinate (Sup Turbinate always hidden) hypertrophied and if there is a deviated septum then DNS is added, this diagnosis is more valid if Nasal endoscopy is also performed in an OSA patient. Nasal endoscopy is mandatory in some mild OSA but strong snorers where a posterior deviation is missed on anterior rhinoscopy and the treatment may be missed.

Indirect Laryngoscopy : Not too helpful as most of these patients have a hyper gag reflex and do not allow it. More so there is little space to introduce a mirror for examination. In patients who are of low BMI and are primarily only snorers, the space is adequate. But since a fibroptic Laryngoscopy is to be performed then this step can be skipped. Evaluation of the Airway just by Indirect Laryngoscopy is not possible at all.

Fibroptic Laryngoscopy (FOL) (Sher, 1986) : This is the most important test to be performed in a OSA patient. This is performed in local anaesthesia with the patient in supine position. The post nasal space, nasopharynx and the Palatal lie is observed. The hypopharynx is also observed for the level of obstruction. A maneuver called Muller's is performed to exactly pin point

Table I
Table Showing the normal values and grading of Oral Cavity (Mesopharyngometry)

Tongue			
Grade I	Whole fauces seen		
Grade II	Part of tonsils seen		
Grade III	Fauces not seen at all		
Palate	Low Lying	Short and Thin	Deep and Shallow
Uvula	Length	>10 mm Abnormal	10 & <10 mm Normal
Uvula	Width	>5 mm Abnormal	<5 mm Normal
Tonsils			
Grade O	Tonsils Submerged		
Grade I	Post Pillars seen		
Grade II	Post Pillar partly seen		
Grade III	Post Pillar not seen	Tonsil meeting midline	
Post Pillars (distance)	<20 mm Abnormal	>20 mm Normal	
Lat. Pharyngeal band			
Grade I	Hidden Behind post Pillar		
Grade II	Partly seen		
Grade III	Midline		

Table II
Table Showing the Normal Values for Cephalometry (X-Ray Soft Tissue Neck-Lateral View)

S.No.	Bony Landmarks and Surface marking	Abbr.	Value	Inference
1.	Distance Between the line passing through Gonion and Gnathion & Hyoid Bone	Gn-H	15-20 mm	Level of the Height of Hyoid bone
2.	Distance between the Go-Gn Line and the space behind the base tongue in the same plane	PAS	10-12 mm	Tells us all about the retroglossal Airway
3.	Angle formed between Sphenoid, Nasion and Anterior Nasal Spine	SNA	80-90 degree	Maxillary bone deformity
4.	Angle formed between Sphenoid, Nasion and Basion	SNB	80-90 degree	Mandibular Hypoplasia & it's deformities
5.	Distance between the edge of hard palate and the tip of soft palate	SPL	37 mm	The soft palate length
6.	Distance between epiglottis and post pharyngeal wall	PEA	20-30 mm	Hypopharyngeal Airway
7.	Distance between uvula and posterior pharyngeal wall	PUA	15-20 mm	Oropharyngeal dimension in anterior posterior plane

Table III
Table Showing the Pattern of Fibroptic Endoscopic Evaluation

S.No.	Examination & Findings	Inference, Grading and Importance
1.	Nasopharyngeal Airway	Narrow or wide
2.	Post Nasal Space	Adenoids, Mass etc.
3.	Soft Palate	Bulky, Long, Short, Oedematous & closing pattern
4.	Lateral Pharyngeal bands	Grades I, II, III & Contribution to closing pattern
5.	Muller's Manv. at this level I	Grades I, II, III & Contribution of LPB compared to palate
6.	Lateral Hypopharyngeal wall	Closing pattern, plane of closure-sagittal or coronal
7.	Epiglottis	Shape, thick, thin, distance from past pharyngeal wall
8.	Valleculla	Present normal size, moderate, fully obliterated
9.	Base of tongue	Grades I, II, III
10.	Muller's at his level II	Positive or not-comparison of position of tongue to PPW
11.	Lingual tonsils	Hypertrophy or not
12.	Larynx	Normal Anatomy or abnormality

the level of obstruction. This test is conducted by asking the patient to breathe against a closed mouth and nose, thus mimicking a soft tissue collapse akin to that occurring during sleep. This maneuver is very helpful and is a standard test performed in all major centers of the world.

Cephalometry (Riley, 1990) : Lateral soft tissue x-rays are taken of the Nasopharynx and the neck, with the patient breathing deeply and with mouth closed, if facility is available and there is no time constraint then x-rays can be taken in both sitting and then in supine position. This important test is important to find out the exact level of obstruction and correlate it with the Fibroptic findings. This tells us all about the level of the Hyoid bone, the Mandibular and the Maxillary bony angles, the Base tongue and posterior airway space and also the length of the soft palate. This is the important test as it will decide the type of surgery to be performed in a OSA patient. The success and failure of the results depends on the value of the x-ray and the FOL evaluation. The methodology of the measurements is not in the scope of this paper and will be dealt with elsewhere along with the data as compared to the normal non-OSA patients. There is also a

considerable difference between the cephalometric findings of a snorer with OSA and a snorer with no OSA.

Diagnosis : After all these tests are done, then based on clinical findings alone the patients are sent for a Polysomnographic examination to find out the outcome of the sleep pattern. The PSG helps quantify the diagnosis and tells us about the severity of the disorder. This test can also help distinguished between cases of classical Sleep Apnea and Upper Airway Resistance Syndrome (Guilleminault, 1993). The author uses a specially prepared Performa to fill all the complaints and the findings of the patient. The center has also developed a scoring system to quantify the level of disability due to excessive daytime sleepiness. This excessive daytime sleepiness and snoring clinches partly the clinical diagnosis of OSA, which has to be proved by a Polysomnograph (PSG).

CONCLUSION

The main aim of this paper is to share the methods used by the department to diagnose a case of Sleep Apnea. Since the interest of ENT Surgeons in this field has grown leaps and bounds, it is

mandatory that there should be a definite way to carry out all the tests and document them. The center has been working with the sleep center of this hospital for the last 3 years and have a fixed protocol to diagnose and treat these cases. This center has also treated cases of Sleep Apnea but the discussion and presentation is beyond the scope of this paper. This paper is primarily to acquaint an ENT Surgeon with the drill of the examination performed. There are many ENT surgeons who treat every case of snoring as Sleep Apnea and go ahead with surgical procedures like Septoplasty and Tonsillectomy, without evaluating the cases and carrying out any Polygraph recordings. Even if the PSG facilities are not available or are costly, the shortcuts may prove deadly in the long run. Treatment failures in the best of centers have been due to improper evaluations and there is general rethinking going

on as to how to carrying out a particular procedure, as the results are still not satisfactory. A clinical diagnosis of OSA without PSG is not followed in any center but there are studies going on and there will be a day when these tests will no longer be a detrimental factor for the diagnosis of OSA. Our center uses a thoroughly filled questionnaire, Fibroptic findings and X-ray measurements as a tool to isolate a probable case of Sleep Apnea but always quantifies it with a Polysomnograph. Though our figures match (study under statistical scrutiny) but still it will need a lot of cases to establish a proper norm or protocol.

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