ORIGINAL ARTICLE

Evaluation of Polysomnographic Patterns with Reference to Various Treatment Modalities in the Management of Patients with Upper Airway Obstruction

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ABSTRACT

Seventy five patients with symptoms and signs of upper airway obstruction and OSAS were studied. Clinical, endoscopic, radiological and polysomnographic examination were performed. An approriate surgical procedure to correct the upper airway obstruction was performed. All patients were followed up for a period of 12 weeks, at the end of which a polysomnographic examination was repeated. The results of the study are discussed.

Introduction

Obstructive sleep apnea syndrome (OSAS) is a severe form of upper airway dysfunction resulting from anatomical narrowing as well as abnormal neuromuscular control of the upper airway in these patients. Common abnormalities leading to airway narrowing include soft palate elongation, adeno-tonsillar hypertrophy, macroglossia, retrognathia and micrognathia. Polysomnography is the gold standard to diagnose obstructive sleep apnea. CPAP therapy is the only effective non-surgical method to treat such patients. Surgical management includes volumetric reduction of the soft tissues of adenoiods, palate, lateral pharyngeal wall, tongue, hyoid and the bony skeleton of the face like the mandible and the maxilla. A study was carried out to detect the structural changes in the upper airway obstruction and OSAS and simultaneously identify the objective changes in polysomnographic analysis of these patients before and after three months after upper airway surgery.

Materials and Methods

Seventyfive patients with symptoms and signs suggestive of upper airway obstruction were studied. A detailed history was taken. A questionnaire for sleep disturbances (which included items pertaining to snoring, excessive daytime sleepiness, choking at night, and tiredness in the morning, mouth opening during sleep, nocturnal enuresis, performance in school and growth characteristics) was also filled up.

A complete physical examination including a thorough oto-rhino-laryngological examination was performed. Anterior rhinoscopy, grading of tongue and tonsils, examination of palate, uvula, larynx and ears were also carried out. Hematological examination, arterial blood gas analysis, pulmonary function tests, skiagraphy of chest, paranasal sinuses (Water's view), soft tissue of neck (lateral view), and nasopharynx (dead lateral view), were done to assess the level and extent of obstruction. Plain computerized scans (non-contrast enhanced, axial cuts from frontal sinus to the hyoid bone) were done

whenever possible and required. Diagnostic nasal endoscopy (using 0° 4 mm Karl Storz endoscope) and flexible fiberoptic laryngoscopy (using ENT T3 laryngoscope) was done and photographic images obtained (using a Storz camera).

All patients were then subjected to a whole night polysomnography in the sleep laboratory (using Alice 3 Healthdyne sleep lab. system). Continuous recording of EEG, EMG, EOG, and ECG, nasal and oral airflow, thoracic and abdominal movements and pulse oxymetry was conducted during the sleep study. EEG was recorded using the International Ten Twenty system from C3 or C4 electrode referenced to the 'inactive' electrode on the contralateral mastoid process (C4-A1 or C3-A2). The polygraph was recorded at a speed of 10 or 15 mm/sec. The sleep study record was analysed the subsequent morning.

Patients were then subjected to surgical interventions directed to the cause of upper airway obstruction and this comprised septoplasty/submucosal resection, polypectomy, adenotonsillectomy, uvulopalatopharyngoplasty or a combination of these procedures. All patients were then followed up at weekly intervals, noting the subjective improvement in various symptoms. Objective evaluation was done by a polysomnographic study post-operatively after a period of 12 weeks. Polysomnography was repeated after three months of the surgical intervention.

Observations and Results

Seventyfive patients were included in the study. The age of the patients ranged from 35 days to 60 years. There were 30 children (<15 years) and 45 adults. They included 56 males and 19 female subjects. All the 75 patients complained of snoring and mouth breathing. Other symptoms amongst children included restless sleep, breathing pause, frequent cold, excessive daytime sleepiness, nocturnal choking, difficulty in swallowing, nasal discharge, mood swings, poor attention, enuresis, aggressive / hyperactive behaviour and failure to thrive. Adult patients, in addition, presented with nocturia, breathing pauses, restless sleep, nocturnal enuresis, morning headache, dry mouth, unrefreshing sleep, poor concentration, decreased attention, drooling, reduced dexterity, depression and personality changes.

Morphometric studies of adults showed nuchal obesity (>40 cm) in 82% patients and BMI of >25 in 83% cases. Polysomnographic findings observed after a whole night sleep study that was done pre-operatively in all patients revealed Apnea Hypopnea index (AHI) ranging from 0.2 to 98. Oxygen saturation ranged from 51.5% to 98%. The patients who had shown a long and thick soft palate on clinical examination had a higher AHI and a lower minimum SaO2 when compared with patients having a normal or only a long palate.

Patients with an enlarged tongue (i.e. Grade III) had an average AHI of 41.5 / hour and patients with a Grade I tongue an AHI of 2.2 / hour. Patients with an oedematous uvula also had a higher AHI when compared with normal. Patients with webbing and reduced inter-pillar distance had average AHI of 46.3 / hour which was higher than patients with only webbing i.e. 25 per hour. Patients with Grade III lateral pharyngeal bands had a significantly higher AHI i.e. 61.9 per hour than those with a Grade I band i.e. 23.5 / hour.

The appropriate surgical procedures were carried out. The patients were followed up post-operatively and assessed for the degree of relief in various symptoms. Symptomatic improvement was evaluated by refilling the questionnaire. The pediatric patients showed significant improvement in both night and daytime symptoms. They started gaining weight following surgery, showed improvement in their behavioural problems and fared better in school. In the sleep laboratory, split night studies were performed. During the first half of the night, the test was used to diagnose the presence and the type of sleep-disordered breathing. During the second half, titration of NCPAP pressure was done.

Amongst adults, improvement was noted in 88.24% of the patients using NCPAP who showed a reduction in the AHI of >50% and minimal oxygen desaturation (below 90%). One patient with UPPP with hyoid suspension, one with weight management alone and four with NCPAP did not show much improvement. The improvement in children as on repeat polysomnography was seen in 86%. All the patients who showed severe OSA and multiple levels of obstruction were advised NCPAP. Approximately 88.24% cases showed a marked improvement in quality of sleep and qualty of life. Two patients (one with severe OSAS with cor pulmonale and another who was not compliant with therapy) did not show a marked improvement.

The various treatment modalities administered are outlined in Table-1.

Table1: Treatment modalities

Treatment	Number of patients (n=75)	Percentage
NCPAP with weight management	17	22.67
Adenotonsillectomy	18	24
Adenoidectomy	7	9.33
Weight management	4	5.33
Thyroid hormone replacement with weight management	3	4
Thyroid hormone replacement with weight management with NCPAP	1	1.33
UPPP with weight management	1	1.33
UPPP with hyoid suspension with weight management	3	4
UPPP with thyroid hormone with weight management	1	1.33
UPPP with tonsillectomy	3	4
Tonsillectomy	2	2.67
Tracheostomy with UPPP with adenoidectomy with mandibular distraction	2	2.67
Mandibular distraction	1	1.33
Adenoidectomy with partial uvuloplasty	1	1.33
Septoplasty with spur correction	1	1.33
Septoplasty	1	1.33
SMR with palatoplasty	1	1.33
Polypectomy	2	2.67
Adenotonsillectomy with palatoplasty	2	2.67
Spurectomy with FESS & palatoplasty	1	1.33
Sub-mucosal resection (SMR)	2	2.67

Discussion

Analysing eight studies comprising 412 participants, a Cochrane database review could not detect any evidence to support the use of surgery in sleep apnea / hyponea syndrome, as overall significant benefit had not been demonstrated (1). Surgical correction of the upper airway (UPPP) has been shown only to improve snoring and sleepiness subjectively but not to significantly improve RDI or sleep architecture (2). Recent studies have made several intersting observations. . Adenoidectomy should not be performed in dysmorphic, allergic or phlogistic pathologies characterized by its moderate or discrete hypertrophy (3). Complete tooth loss often favours upper airway obstruction during sleep (4). Upper airway pressure measurement can objectively identify the level of obstruction during sleep (5). Interventions to relieve the upper airway obstruction were met only with variable success in another study; tonsillectomy (100%), UPPP (41%), and nasal surgery (4.2%) (6). Phase I surgery (which includes nasal reconstruction, UPPP, base of tongue and hypopharyngeal surgery) has a documented success rate of about 70 to 80%. Phase II surgery (maxillo-mandibular advancement), which has a success rate of approximately 100%, may be used as the primary treatment of OSA (7). The need for a pre-operative investigation of the upper airway during sleep to select patients with collapse confined to the oropharynx is of paramount importance (2). On review of 68 patients, the relevance of combining clinical examination with

cephalometric, endoscopic and polysomnographic examination was underscored (8). The prevalence of OSAS in children was determined as 0.7% to 3% with peak incidence in pre-schoolers (9). It has also been opined that snoring and OSA may be corrected merely by septal surgery with/witout inferior turbinectomy in some patients, and secondary surgery (UPPP) may be considered after a thorough evaluation by means of post-operative polysomnography (10).

Primary snoring was seen in 8%, UARS in 6% and OSAS in 86% of the patients. It was also observed that the grade of tonsillar enlargement correlated with RDI. Amongst appropriate surgical procedures performed in children, adenotonsillectomy was the most commonly performed one. Polysomnography, on follow up, showed reduction of obstructive episodes, reduction in the number of awakenings in sleep, improved oxygen saturation and snoring. The number of stage shifts decreased and sleep efficiency increased, and there was increase in sleep as observed in a few cases.

Two children presented in severe respiratory distress and needed emergency tracheostomy. Upper airway pharyngolaryngoscopy with Mueller's maneuver was performed in adult patients to locate the level of upper airway obstruction. Three adults with multiple levels of obstruction were subjected to UPPP with hyoid suspension and one with a level I obstruction underwent UPPP.

Although improvement was most marked following the appropriate surgical procedure in children, this was not so encouraging amongst adults. This sluggish response to surgery may, perhaps, be attributable to to the obstructions of the upper airway at multiple levels. Significant improvement in sleep quality, sleep architecture and reduction in RDI was observed following the use of NCPAP (in upto 88.24% of severe OSA patients).

It may be concluded that a careful clinical, cephalometric, endoscopic and polysomnographic evaluation is of paramount importance in the diagnostic work-up of any patient presenting with upper airway obstruction and OSAS. Surgical correction of the obstruction is of maximum benefit in the pediatric population; NCPAP is the most comprehensive and non-invasive therapeutic modality applicable to the adult patients.

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