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Paediatric obstructive sleep apnoea: is a polysomnogram always necessary?

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Abstract

Obstructive sleep apnoea (OSA) is a common entity in children, most present with sleep disturbances such as snoring, choking during sleep, enuresis, restless sleep, or apnoeic spells. Other symptoms include poor school performance, hyperactivity, failure to thrive, heart failure and cor pulmonale. Most authors would concur that the polysomnogram (PSG) is the gold standard for the diagnosis of OSA, and that adenotonsillectomy is the surgical procedure of choice, with high curative rates and relatively low morbidity. Close post-operative monitoring of all children with OSA cannot be over-emphasized. The focus has been, traditionally, to anticipate post-operative airway and respiratory complications in this group of children. We present 73 children with clinical OSA and 36 children with proven OSA on PSG, with only one child having respiratory complications (mixed apnoea), and all with uneventful recovery. In view of our low complication rates, low post-operative morbidity, cost and facility factor, the need for a mandatory overnight PSG pre-operatively is questioned, and clinical criteria for performing a PSG pre-operatively are suggested.

Key words: Child; Sleep Apnoea, Obstructive; Monitoring, Physiologic; Treatment Outcome

Introduction

Sleep-related breathing disorders range in disease severity from primary or simple snoring, through upper airway resistance syndrome (UARS) to obstructive sleep apnoea (OSA), at the severe end of the spectrum. Children can present with snoring, a choking sensation, cessation of breathing (apnoea), restless sleep, or enuresis. In children, classical obstructive sleep apnoea can occasionally result in poor school performance,[1,2] failure to thrive,[3] cor pulmonale[3,4] and even hypertension[5] and heart failure. This syndrome occurs in about 0.7 to four per cent of children,[6] most authors concur that the prevalence of OSA between two to six years old is one per cent, when the tonsils and adenoids are largest relative to the pharyngeal space.[7–9] Hence, the majority of paediatric OSA cases are treated with adenotonsillectomy. Although this surgical procedure is believed to be curative in up to 75 to 100 per cent of children with OSA, including those who are obese,[10] its complications such as haemorrhage and perioperative respiratory compromise, have been reported to be between 16 to 23 per cent.[11,12] With such a relatively high complication rate in this paediatric age group, many authors advocate mandatory pre-operative overnight polysomnograms for all patients with adenotonsillar hypertrophy, suspected of having obstructive sleep apnoea (OSA). Messner (1999) disputed the use of pre-operative polysomnogram for evaluation of obstructive sleep apnoea in children,[13] creating the question is a pre-operative overnight polysomnogram mandatory for all patients?

Subjects and methods

This was a retrospective review of all children with clinical suspicion of OSA, with, or without, documented overnight polysomnogram, who underwent adenotonsillectomy from January 1999 to December 2000, in our local KK Women and Children's Hospital Singapore.

Results

One hundred and nine children, between three to 14 years of age, underwent an adenotonsillectomy for clinical suspicion of OSA. The sex ratio was 2:1, male:female. The racial distribution was very similar to the country's racial fractions, i.e. 62.4 per cent Chinese, 23 per cent Malays, 10.0 per cent Indians and 4.5 per cent for other races.

All 109 children presented with the chief complaint of snoring. Ninety-four per cent of parents also complained that their child had experienced a

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choking sensation while asleep, or was witnessed to be choking in their sleep. Only 32 per cent of patients actually had daytime somnolence or excessive tiredness. Most of the children were also mouth breathers while sleeping. Clinical examination revealed the majority to be of average height and weight, within the 25th and 75th percentile, only a small number were above the 95th percentile. Applying the body mass index (BMI)-for-age calculation for children, all patients were within the fifth to the 85th percentile, i.e. healthy weight.[14] Tonsillar enlargement was graded as 3+ to 4+ bilaterally. As a nasoendoscopy is not well tolerated in a child, adenoid enlargement was assessed intra-operatively.

Thirty-six patients (33 per cent) had a pre-operative PSG performed, while the other 73 children were treated on clinical suspicion of OSA. The authors ordered a PSG only if the patient was obese and the adenotonsillar enlargement was not consistent with the clinical symptoms.

Some of these children had other associated co-morbid diseases, and these were similar in both the clinically suspected OSA group and the PSG-proven OSA group, namely, recurrent tonsillitis (29.5 per cent), allergic rhinitis (39 per cent), bronchial asthma (11.9 per cent), Down's syndrome (2.4 per cent), and insulin resistance syndrome (8.3 per cent). Other less common conditions included, mental retardation, a patent ductus arteriosus, hypothyroidism, and achondroplasia. Due to the authors' tendency to order a PSG only for the more obese children, the obesity rate was naturally higher in the PSG-proven OSA group. The BMI for the clinically suspected OSA group was 22.3 compared to 30.1 in the OSA-proven PSG group.

There were a total of 36 PSGs performed for our patients. These were those patients whose clinical symptoms were deemed not consistent with the clinical examination. The average BMI in this group was 30.1 (range of 21 to 57.7). The average lowest oxygen saturation) (LSAT) was 78 per cent (ranging from 45 to 93 per cent). The apnoea-hypopnoea index (AHI) ranged from 2.9 to 86.2 (average of 24.1). The sleep efficiency ranged from 57.2 to 91 per cent, with most children falling between 85 to 95 per cent.

Seventy-eight per cent of our patients had an adenotonsillectomy, and 22 per cent had a tonsillectomy. Nine per cent had bilateral myringotomy and grommet tube insertion performed at the same time, and all these patients were found to have obstructing adenoids. The average hospital stay was three days, most patients were placed in high dependency (HD) monitoring for the first post-operative day, where continuous electrocardiogram (ECG) and continuous overnight oxygen saturation was monitored. Only one patient, out of the 109 patients, experienced two episodes of oxygen desaturation, down to a low of 81 per cent, on the second post-operative day. This was an obese child with insulin resistance syndrome, who had both central and peripheral apnoeas documented on PSG pre-operatively. The child did not require any surgical intervention, nasal continuous positive airway pressure (CPAP) maintained oxygen saturations in this child. There were no other respiratory or airway complications in all the other 108 patients post-operatively. Surgical complications such as primary haemorrhage were noted in two patients (1.8 per cent), both had bleeding from the adenoid bed, and both required haemostasis under general anaesthesia. Secondary haemorrhage was documented in three patients (2.7 per cent), all of which bled from the tonsillar bed and required haemostasis under general anaesthesia.

All patients recovered well post-operatively. Only the child with mixed apnoea required home nasal CPAP despite the adenotonsillectomy. Ninety per cent of all the patients had resolution of their snoring and choking symptoms. The other 10 per cent of patients had improvement of symptoms, but had mild persistent stridor from the associated allergic rhinitis, these improved with non-sedating antihistamines and topical nasal steroid sprays. The average follow-up time was 14 months.

Discussion

It is well known that OSA is common in the paediatric age group, and most would agree that adenotonsillar hypertrophy is the leading cause. Other risk factors include craniofacial abnormalities, neuromuscular disease, and other syndromic or genetic diseases.[15] Children with OSA can have sleep disturbances such as snoring, choking at sleep, sitting up at sleep, enuresis, and witnessed apnoeic spells. Children can also present with non-specific behavioural difficulties, such as hyperactivity, developmental delay, aggressive behaviour, poor performance at school and failure to thrive. We found, similar to Abisheganaden *et al,*[16] that snoring and choking while asleep correlated best to the likelihood of OSA. Only about one third of our patients had excessive daytime tiredness, or daytime somnolence.

Most otolaryngologists and paediatricians would agree that an overnight PSG is the gold standard for the diagnosis of OSA.[17] However, depending on the centre, cost and availability of the facilities, this is not always possible. Moreover, the criteria of OSA, from the interpretation of the PSG is also not always so straight-forward. There are many advantages and disadvantages in the interpretation of an overnight PSG for a child. Many authors too, have different definitions of OSA and an apnoeic episode. Suen *et al.*[18] and Wang *et al.*[19] used the criteria for adults, i.e. a pause of 10 seconds as the definition of aponoea and an AHI of more than five as OSA, however, they found no 'significant association between clinical parameters and the presence of OSAs as defined by PSG'. Goldstein *et al.*[20] and Leach *et al.*[21] defined an apnoeic spell as cessation of airflow for two and a half breaths with continued respiratory effort, and OSA as more than 15 per hour. Carroll *et al.*[22], conversely, defined apnoea as cessation of airflow for two breaths associated with a four per cent oxygen desaturation and with con-

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tinued respiratory effort, and AHI more than one. Nieminen *et al.*[23] agreed with Carroll *et al.*[22] that an AHI of more than one was sufficient for the diagnosis of OSA, but also concurred that an apnoeic episode should be defined as 10 seconds or more.

Rosen *et al.*[24] disagreed with using adult PSG parameters as criteria for diagnosing OSA in children. They studied 20 children with documented snoring and difficulty in breathing with episodes of desaturation of 90 per cent or less and end-tidal carbon dioxide of 50 mmHg or higher, and found that using adult PSG criteria for diagnosing OSA in children is inadequate and erroneous. Due to the faster respiratory rate in children, 10 seconds may represent two to three breaths in an adult, but may be five to six missed breaths in a child. Moreover, the PSG results may be misleading as it only measures sleep and breathing patterns in one night, and may not represent the child's regular sleep pattern. Marcus *et al.*[25] studied 50 healthy children aged one to 18 years of age, they found the normal apnoeic indices in these children were 0.1 ± 0.5. Hence, they concluded that more than one episode of obstructive sleep apnoea should be considered abnormal in the paediatric age group. Despite all these different definitions and interpretations of the PSG, McColley *et al.*[12] found that an AHI of more than 10 correlated with an increased risk of post-operative complications.

Seventy-eight per cent of our patients had an adenotonsillectomy performed, while only 22 per cent of our children had tonsillectomy alone. No difference was found in the clinical success rate between the two surgical procedures, adenoidectomy was performed only if it was found to be obstructing the posterior choanae intra-operatively. Myringotomies and ventilation tubes were inserted for patients with persistent glue ears despite adequate medical therapy. All 109 patients recovered well post-operatively, most were monitored in the high dependency unit overnight on the first post-operative day. There were no significant respiratory complications except for one child with mixed, central and peripheral apnoea, who was treated with home nasal CPAP upon discharge. Many authors have found that, contrary to popular belief, thin children with OSA have higher respiratory complication rates than OSA children who are obese.[11] This is due to the fact that these thin OSA children have failure to thrive,[11,26] resulting from the chronically oxygen-deprived state. Rosen *et al.*[26] studied 37 children with OSA, and identified seven criteria for children, with high risk of post-operative complications, these include: (1) <2 years of age, (2) craniofacial abnormalities, midface hypoplasia, retrognathia, (3) failure to thrive, (4) hypotonia, (5) cor pulmonale, (6) morbid obesity and (7) AHI >40, LSAT <70 per cent.[26] In our review of these 109 children, we did not find any of these criteria applicable. We attribute this to the fact that, perhaps, our complication rates were low.

- **It is normally considered necessary to investigate children suspected of having obstructive sleep apnoea with polysomnography prior to surgery, although this approach has been questioned[13]**
- **In this cohort study the post-operative outcome in 73 children with clinical OSA and 36 with proven OSA were compared**
- **Only one child had a complication following surgery**
- **In the light of this the authors suggest revised clinical criteria for performing polysomnography pre-operatively**

As none of our patients had a post-operative PSG done, we based our success on clinical symptoms of resolution of snoring, choking at sleep and daytime somnolence. Ninety per cent of our patients had resolution of snoring and choking at sleep, the other 10 per cent required topical nasal steroid sprays and anti-histamines for their allergic rhinitis, before they had improvement of their snoring.

Conclusion

It is well known that OSA in children is a fairly common entity, and if left untreated can lead to serious complications such as failure to thrive, cor pulmonale, cardiorespiratory failure and developmental delay. It is also widely accepted that adenotonsillectomy is curative for the majority of these children with OSA, with many authors quoting up 100 per cent cure rates.[10] Although an overnight PSG is the gold standard for the diagnosis of OSA, and granted that the post-operative complication rates are low, as demonstrated in our series of 109 children, are we currently over-subscribing to this test (PSG)? We propose that, in view of the high curative rate of adenotonsillectomy, low post-operative complication rate, and low morbidity, only children with clinical suspicion of OSA, but having clinical parameters not consistent with the clinical picture, i.e. minimal adenotonsillar enlargement, morbid obesity, failure to thrive, excessive daytime somnolence, craniofacial abnormalities, and chromosomal abnormalities should undergo a PSG.

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