*The Journal of Laryngology & Otology (2008)*, ***122***, *42–45*.

doi:10.1017/S0022215107007566
Printed in the United Kingdom
First published online 3 April 2007

Main Article

# Obstructive sleep apnoea adenotonsillectomy in children: when to refer to a centre with a paediatric intensive care unit?

E J S M Blenke, A R Anderson, Hemal Raja*, S Bew†, L C Knight

**Abstract**

Objective: To identify regional surgical referral patterns for adenotonsillectomy in children with obstructive sleep apnoea to our tertiary centre with paediatric intensive care unit facilities and to establish guidelines for elective paediatric intensive care unit referral and admission.

Methods: Two methods were used. A questionnaire was sent to ENT consultants in five surrounding hospitals with no in-house paediatric intensive care facilities. The second was a prospective observational study undertaken in our tertiary centre for a sub-set of patients undergoing obstructive sleep apnoea adenotonsillectomy between January 2002 and February 2005. These children were considered high risk as judged clinically by an ENT surgeon. Most had obstructive sleep apnoea and a co-morbidity. Otherwise healthy children with simple obstructive sleep apnoea were excluded.

Results: 15 out of 20 consultants responded to the questionnaire. Four referred on the grounds of clinical history, five referred based on pulse oximetry, nine referred syndromal children and four did not refer electively. Of the 49 high risk patients operated on, only 12 required paediatric intensive care admission with no emergency paediatric intensive care admissions. No otherwise healthy children with uncomplicated obstructive sleep apnoea symptoms required paediatric intensive care admission during the study period.

Conclusion: There was no regional consensus regarding paediatric intensive care unit referral for obstructive sleep apnoea adenotonsillectomy. Clinical judgement without complex sleep studies by those experienced in this area was sufficient to detect complicated cases of obstructive sleep apnoea with co-morbidity requiring paediatric intensive care.

**Key words: Obstructive Sleep Apnoea, Child; Adenoidectomy; Tonsillectomy; Intensive Care**

## Introduction

Obstructive sleep apnoea (OSA) is characterised by oxygen desaturation and reduced oronasal airflow despite preserved thoracic and abdominal respiratory effort.[1] It is a common childhood problem affecting 1–3 per cent of all children. It can manifest itself with habitual snoring, mouth breathing and observed apnoeic episodes, restless sleep, enuresis and behavioural problems.[2] Recent research has also shown that OSA may affect a child's ability to learn.[3] Adenotonsillectomy is generally accepted as an effective way of treating this problem in children with adenotonsillar enlargement.[4] It is a well-known fact that some children suffering with OSA do poorly after elective adenotonsillectomy, sometimes requiring paediatric intensive care unit level care. It is also well known that paediatric intensive care beds are a scarce and expensive commodity, making appropriate bed usage an important issue. In the literature there appears to be little consensus on how to identify the 'high risk' child pre-operatively. American guidelines advocate complex sleep studies; some advocate the use of overnight oximetry studies whilst others depend merely on clinical suspicion.[5]

We set out to clarify two aspects of elective paediatric adenotonsillectomy. Firstly, we aimed to identify regional surgical referral patterns for adenotonsillectomy in children with OSA to our tertiary referral centre. Secondly, we wanted to develop guidelines for referral to our regional unit to aid selection of those children likely to require intensive care following OSA adenotonsillectomy.

From the Department of Otolaryngology – Head and Neck Surgery, and the †Department of Anaesthesia, The General Infirmary at Leeds, Leeds and the *Department of Otolaryngology – Head and Neck Surgery, Hull Royal Infirmary, Hull, UK.
Presented in poster format at the North of England Otolaryngology Society Meeting, Wakefield, 17th September 2005.
The 46th Annual meeting of the Irish Otolaryngological Head and Neck society, Westport, Republic of Ireland, 8th October 2007.
Accepted for publication: 30 January 2007.

## Methods

This study consisted of two parts, namely a questionnaire and a prospective study. The questionnaire was used to identify regional surgical referral patterns (Appendix I). It was sent to all consultant otolaryngologists in five surrounding hospitals, with no on-site paediatric intensive care facilities, in the region of West Yorkshire, UK. A prospective observational study was performed in our department over a three-year period between January 2002 and February 2005 to identify which children actually required paediatric intensive care admission following OSA adenotonsillectomy. All 'high risk' children undergoing adenotonsillectomy were included. Considered 'high risk' were those referred with severe OSA on the basis of (overnight) oximetry studies with documented nocturnal desaturation below 80 per cent, those admitted to hospital with concerns about frequent apnoeas, those with OSA plus a syndrome associated with airway problems, those with OSA and neurological conditions associated with altered muscle tone, and children with OSA and one or more co-morbidities as judged significant by a senior paediatric otolaryngologist and paediatric anaesthetist. All healthy children with otherwise 'simple OSA' were excluded. Data on most severe co-morbidity, pre-operative OSA investigation, planned post-operative destination, duration of paediatric intensive care unit admission and intra- and post-operative complications were collected.

## Results

### *Questionnaire*

The response rate for the questionnaire was 15 out of 20 (75 per cent). Three consultants indicated they would refer patients pre-operatively to the tertiary centre on the basis of a clinical history alone. Five consultants would refer on the basis of oximetry. Nine consultants stated they would refer syndromal children and children with previous peri-operative airway problems. Two consultants stated they would refer on the basis of polysomnography, which is not readily available in this region. Four consultants indicated they would never refer electively for OSA adenotonsillectomy (see Figure 1).

### *Prospective study*

A total number of 49 children met our inclusion criteria for the prospective study. The majority were children with one or more co-morbidities. Most were suffering from neurological and respiratory conditions or syndromes that are associated with disproportion of the upper airways such as Down's syndrome, Di George or CHARGE syndrome (coloboma of the eye, heart anomalies, atresia of the choanae, retardation of growth and/or development, genital and/or urinary abnormalities, ear abnormalities and deafness). Only one otherwise normal child with severe OSA was included (Figure 2). Oximetry studies were available in 59 per cent of cases. A total of 12 patients required elective paediatric intensive care unit admission following OSA adenotonsillectomy (Figure 3). No post-operative emergency admissions were recorded during this period. Figure 3 shows a co-morbidity profile for all patients that went to the paediatric intensive care unit. The majority consisted of neurological conditions and syndromes. Figure 4 shows the treatment required by the patients admitted to the paediatric intensive care unit. Nine patients were simply monitored and received supplementary oxygen. One required a nasopharyngeal airway. One patient required prolonged intubation. This was a child that was admitted with an acute airway obstruction secondary to upper and lower respiratory tract infection. One child required re-intubation. This was a child with Di George syndrome that initially did

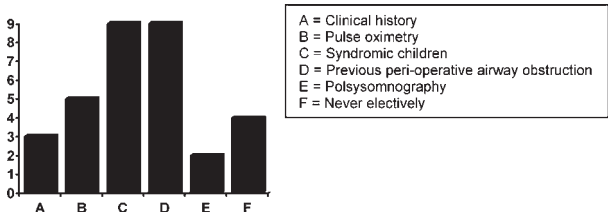


FIG. 1
Results of questionnaire.

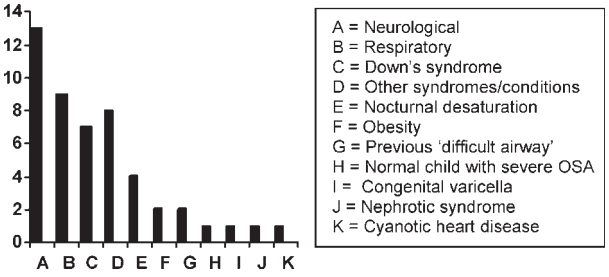


FIG. 2
Profile of most severe co-morbidity of all included patients.

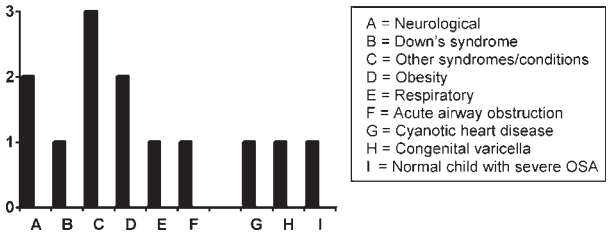


FIG. 3
Profile of most severe co-morbidity in patients requiring paediatric intensive care unit.

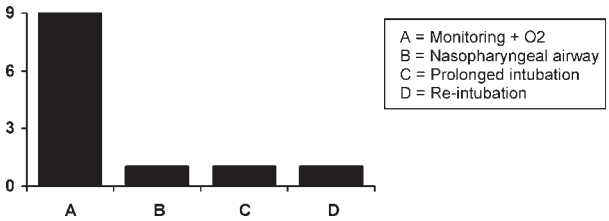


FIG. 4
Treatment in paediatric intensive care unit.

https://doi.org/10.1017/S0022215107007566 Published online by Cambridge University Press

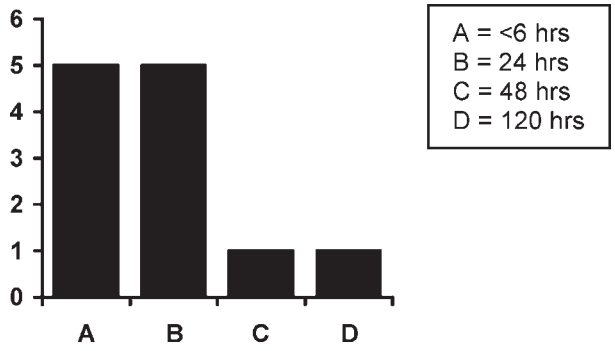


FIG. 5
Duration of paediatric intensive care unit admission.

well but developed acute airway obstruction on the second post-operative day. Subsequently they underwent a tracheostomy followed by a mandibular advancement. The majority of the children admitted to the paediatric intensive care unit were discharged within 24 hours as shown in Figure 5.

## Discussion

Our department performs around 600 paediatric adenotonsillectomies each year. The majority of children referred to our tertiary centre with a view to OSA adenotonsillectomy and potential paediatric intensive care unit level care will have their surgery done routinely without paediatric intensive care facilities having been arranged. This is because they are deemed to be a 'significant risk' on clinical assessment. This in turn means that the family have had to travel extra distances potentially for no difference in care.

In the literature there appears to be little consensus on how to identify the 'high risk' child preoperatively. This is reflected by the current referral practice in our region, which shows little sign of uniformity. For example very few referred children have had overnight oximetry studies.

American guidelines advocate complex sleep studies involving overnight polysomnography and electroencephalogram monitoring as the gold standard.[5] This is currently not widely available for children in the UK. Some, like Nixon *et al.*, advocate the use of overnight oximetry studies which they consider a good tool to estimate the severity of nocturnal hypoxia.[6] Others have reported, however, that overnight oximetry studies should not be used as a basis for deciding which children should proceed to adenotonsillectomy as normal overnight oximetry does not exclude significant obstructive sleep apnoea.[7,8] Others merely depend on clinical suspicion and rely on the history. It has been shown that choking, observed apnoeic episodes, snoring, restless sleep and mouth breathing are the clinical signs correlating to the presence and severity of OSA.[9,10] This in combination with large tonsils and nasal obstruction on examination can function as a basis for deciding which child is likely to have (significant) OSA and therefore will benefit from adenotonsillectomy. It has been argued that clinical assessment is, at present, the most sensitive indicator of OSA, although it lacks specificity.[11]

- **It is a well-known fact that some children suffering with obstructive sleep apnoea have a higher incidence of respiratory complications after elective adenotonsillectomy, sometimes requiring paediatric intensive care**
- **There appears to be little consensus on how to identify the 'high risk' child pre-operatively**
- **This study aims to identify regional surgical referral patterns for adenotonsillectomy in children with obstructive sleep apnoea to a tertiary centre with paediatric intensive care facilities**
- **Clinical judgment without complex sleep studies by those experienced in this area was sufficient to detect complicated cases of OSA with co-morbidity requiring paediatric intensive care**

The 49 'high risk' patients included in the prospective audit consisted of a very heterogeneous group of children. Oximetry studies were available in only 58 per cent of cases. The co-morbidity profile shows a wide variety of problems, with only one normal child with severe OSA included in the study. The decision to arrange paediatric intensive care facilities was made pre-operatively by a senior consultant ENT surgeon and a senior consultant paediatric anaesthetist. These decisions were based on careful clinical assessment and in most cases without the benefits of sleep studies or oximetry studies. Clinical assessment was focused in particular on the coexistence of neurological conditions affecting the airway, syndromes associated with disproportionate upper airways, severe cyanotic congenital heart disease, morbid obesity, acute airway obstruction and respiratory failure. Only 12 children out of the 49 included required paediatric intensive care and no emergency admissions to the paediatric intensive care unit were recorded. A minority of the children admitted to the paediatric intensive care unit required further intervention in the form of invasive airway management. Those were also the patients that required a prolonged stay in intensive care. The majority required 1:1 nursing and oxygen administration and were discharged within 6–24 hours post-operatively, which indicates that they perhaps could have been managed in a paediatric high dependency setting rather than paediatric intensive care unit. Careful anaesthesia in combination with close post-operative monitoring of all children undergoing OSA adenotonsillectomy, regardless of their post-operative destination, however, cannot be over-emphasised.

This study is limited by a number of factors. Firstly, the numbers included are relatively small. Secondly, the size of the referred case load is undetermined; it is unknown which proportion of cases have been referred out of the total number of patients suffering with OSA and how many patients run into problems following surgery in peripheral centres. It is also conceivable that there may be a bias by setting this study in a tertiary centre, which may create a sense of

https://doi.org/10.1017/S0022215107007566 Published online by Cambridge University Press

security as all the 'cavalry' is at hand should complications arise. Other variables may consist of the anaesthetic technique used. Brown *et al.* postulated in 2004 that children with OSA might have reduced morphine requirements for analgesia related to their young age and an up-regulation of central opioid receptors due to recurrent hypoxaemia.[12] In our centre only short acting opiates are used sparingly, if necessary at all, during general anaesthesia for OSA adenotonsillectomy.

## Conclusion

The regional referral study showed that currently there is no regional consensus regarding the need for elective paediatric intensive care referral for OSA adenotonsillectomy.

Based on the results of the audit of 'high risk' patients we conclude that careful clinical assessment by an ENT surgeon and in particular by an experienced senior paediatric anaesthetist is sufficient to plan post-operative care. In our opinion complex sleep studies are not essential in predicting which child requires post-operative paediatric intensive care. On the basis of this study no strict criteria for referral to a centre with a paediatric intensive care unit for elective paediatric intensive care admission following OSA adenotonsillectomy have been determined.

It therefore stands that if the local unit to which an OSA child presents has little experience in clinically assessing OSA patients, a clinical assessment in a tertiary centre may be appropriate and expensive tests may not be.

We strongly recommend referral to a unit with paediatric intensive care facilities in elective paediatric intensive care admission for children with severe OSA plus:

(1) Neurological conditions affecting the airway.
(2) Syndromes associated with disproportionate upper airways.
(3) Severe cyanotic congenital heart disease.
(4) Morbid obesity.
(5) Acute airway obstruction.
(6) Respiratory failure.

### References


1 American Sleep Disorders Association: *The International Classification of Sleep Disorders: Diagnostic and Coding Manual.* Rochester, Mn: American Sleep Disorders Association, 1997;195–7
2 Rosen CL, Larkin EK, Kirchner L, Emancipator JL, Bivins SF, Surovec SA *et al*. Prevalence and risk factors for sleep disordered breathing in 8 to 11 year old children: association with race and prematurity. *J Pediatrics* 2003;**142**: 383–9
3 O'Brien LM, Mervis CB, Holbrook CR, Bruner JL, Klaus CJ, Rugerford J *et al*. Neurobehavioral implications of habitual snoring in children. *Pediatrics* 2004;**113**:44–9
4 Stradling JR, Thomas G, Warley ARH, Williams P, Freeland A. Effect of adenotonsillectomy on nocturnal hypoxaemia, sleep disturbance, and symptoms in snoring children. *Lancet* 1990; **335**:249–366
5 American Academy of Pediatrics. Clinical practice guideline: diagnosis and management of childhood obstructive sleep apnea syndrome. *Pediatrics* 2002;**109**:704–12
6 Nixon GM, Kermack AS, Davis GM, Maoukian JJ, Brown KA, Brouillette RT. Planning adenotonsillectomy in children with obstructive sleep apnea: the role of overnight oximetry. *Pediatrics* 2004;**113**:e19–e25
7 Rosen GM, Muckle RP, Mahowald MW, Goding GS, Ullevig C. Postoperative compromise in children with obstructive sleep apnea: can it be anticipated. *Pediatrics* 1994;**93**:784–8
8 Brouillette RT, Morielli A, Leimanis A, Waters KA, Luciano R, Ducharme FM. Nocturnal pulse oximetry as an abbreviated testing modality for paediatric obstructive sleep apnea. *Pediatrics* 2000;**105**:405–12
9 Abisheganaden J, Chan CC, Chee CB, Yap JC, Poh SC, Wang YT *et al*. The obstructive sleep apnoea syndrome – experience from a referral centre. *Singapore Med J* 1998; **39**:342–6
10 Brouillette R, Hanson D, David R, Klemka L, Szatkowski A, Fernbach S *et al*. A diagnostic approach to suspected obstructive sleep apnea in children. *J Pediatr* 1984;**105**:10–14
11 Kubba H. Comments on childhood obstructive sleep apnoea. *Clin Otolaryngol* 2005;**30**:363
12 Brown KA, Laferriere ABA, Moss IR. Recurrent hypoxemia in young children with obstructive sleep apnea is associated with reduced opioid requirement for analgesia. *Anesthesiology* 2004;**100**:806–10


## APPENDIX I CONSULTANT QUESTIONNAIRE

PICU = paediatric intenstive care unit; HDU = high dependancy unit

We are trying to better define reasons that cause children undergoing adenotonsillectomy (for any indication) to be referred to a tertiary unit for their surgery in the Yorkshire region.

Please indicate your answers to the questions below by placing an X in the appropriate box.

1) Highest level of ward care available to your department
   PICU/HDU ☐ Day case unit ☐
   Short stay ward ☐ Comments ☐
2) Indication(s) for pre-operative referral to unit with a PICU
   Obstructive sleep apnoea from clinical history ☐
   Pulse oximetry demonstrated obstructive sleep apnoea ☐
   Polysomnography demonstrated obstructive sleep apnoea ☐
   Previous peri-operative airway problems ☐
   Syndromic/neurological problems ☐
   Other... ☐
3) Technique used for the majority of paediatric adenotonsillectomies ☐
4) Apart from reasons listed in part 2 do you find your anaesthetic colleagues refer some patients to tertiary centres for surgery based on:
   Age ☐ Other factors ☐
   Concurrent morbidity ☐


Address for correspondence:
Ross Anderson,
33 Lock Keepers Court,
Victoria Dock,
Hull, HU9 1QH, UK.

E-mail: ara@doctors.net.uk



Mr R Anderson takes responsibility for the integrity of the content of the paper.
Competing interests: None declared