

Management of paediatric sleep-disordered breathing

Abstract

Paediatric sleep-disordered breathing is a common condition which varies in severity from snoring to obstructive sleep apnoea. Paediatric sleep-disordered breathing is usually diagnosed clinically, with investigations such as polysomnography reserved for more complex cases. Management can involve watching and waiting, medical or adjunct treatments and adenotonsillectomy. National working groups have sought to standardise the pathway for surgery and improve the management of surgical and anaesthetic complications. Current guidelines use age, weight and comorbidities to stratify risk for these surgical cases. This article summarises these recommendations and outlines the important factors that indicate cases that may be more suitable for management in secondary and tertiary units. Appropriate case selection will reduce pressure on tertiary units while maintaining training opportunities in district general hospitals.

Key words: Obstructive sleep apnoea; Obstructive sleep-disordered breathing; Otorhinolaryngology; Paediatric; Paediatric respiratory; Sleep-disordered breathing; Tertiary care

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Introduction

Paediatric sleep-disordered breathing is a spectrum of disease ranging from simple snoring to obstructive sleep apnoea, with significant desaturations overnight. It is one of the most common conditions seen in tertiary paediatric otorhinolaryngology clinics, and patients frequently present for surgical management in district general hospitals. The prevalence of paediatric sleep-disordered breathing varies between 4% and 11% (Lumeng and Chervin, 2008). The condition is thought to be more prevalent in children who are premature, living with obesity, or of Black or Hispanic descent (Rosen et al, 2003; Goldstein et al, 2011).

In contrast to adults, sleep-disordered breathing in children is often secondary to reduced oro-nasal airflow as a result of adenotonsillar enlargement. Typically, children present with loud snoring and periods of partial or complete obstruction of the upper airways during sleep. This obstruction can lead to episodes of oxygen desaturation and hypercapnia, which can cause frequent arousals during sleep and a fragmented sleeping pattern (Tan et al, 2013). Untreated sleep-disordered breathing can lead to daytime sleepiness and behavioural problems such as hyperactivity and inattention. Severe obstructive sleep apnoea can result in failure to thrive and cardiovascular consequences including hypertension, right and left ventricular dysfunction and cor pulmonale (Blackshaw et al, 2020).

Paediatric sleep-disordered breathing is usually diagnosed through clinical assessment, with polysomnography reserved for more complex cases. Management options include conservative, medical and surgical approaches. Sleep-disordered breathing is one of the most common indications for adenotonsillectomy (Kubba and Downie, 2021). The report *Safe Delivery of Paediatric ENT Surgery in the UK: A National Strategy* provides a framework for management of these patients (Hartley et al, 2019).

Diagnosis

Children suspected of having sleep-disordered breathing should be referred to a specialist paediatric respiratory sleep physician or paediatric otolaryngologist. The diagnosis is usually made through detailed clinical assessment, with further investigation not required.

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The examination may show nasal obstruction and adenoidal and tonsillar enlargement. The classical history of a child with sleep-disordered breathing is snoring, mouth breathing, breath holding, restlessness, enuresis, hyperactivity and attention deficit, and more rarely failure to thrive (Alexopoulos et al, 2005; Sans Capdevila et al, 2008). Understanding the risk factors associated with paediatric sleep-disordered breathing, such as racial disparities, prematurity and obesity, is important to identify those at increased risk (Goldstein et al, 2011).

Pulse oximetry is not a useful screening tool in patients with sleep-disordered breathing as it has very poor sensitivity (Brouillette et al, 2000). Working groups have attempted to categorise the severity of obstructive sleep-disordered breathing with the use of polysomnography, but have yet to reach consensus; however, several studies have used the apnoea–hypopnoea index to classify mild (1–4.9), moderate (5–9.9) and severe (>10) disease (Mitchell et al, 2019). Polysomnography is the gold standard investigation in sleep-disordered breathing but is expensive, has limited availability, and is labour and resource intensive (Hartley et al, 2019). Clinical decision making is recommended as the only tool required for most children with sleep-disordered breathing, as polysomnography adds little in terms of risk assessment compared with clinical predictors (Hartley et al, 2019). Therefore, polysomnography and apnoea–hypopnoea index are only considered useful in complex cases including those with significant comorbidities or where there is diagnostic uncertainty.

Management

The decision to treat children with sleep-disordered breathing is best made in a multidisciplinary setting and should include paediatric respiratory sleep physicians, otolaryngologists, general paediatricians and specialist respiratory nurses. The choice of treatment depends on the clinical symptoms, the age of the child, comorbidities, risk factors, polysomnography results if performed and parental wishes. The treatment options include watchful waiting (with or without medical treatment), mechanical devices and surgical interventions.

Watchful waiting

For otherwise healthy children with mild to moderate sleep-disordered breathing, watchful waiting with supportive care is an option. Supportive treatment may include optimisation of other medical conditions including asthma and allergic rhinitis. Sleep-disordered breathing in children can often be complicated with obesity, and weight loss may help in some cases (Indra and Joseph, 2012). Management of co-existent allergic rhinitis should be initiated, and advice on allergen avoidance should be provided. Children who have allergic rhinitis with mild or moderate sleep-disordered breathing may be offered topical nasal steroids, either while waiting for surgical intervention or as an alternative to surgery. Good quality studies have shown benefit of topical nasal steroids to children with mild obstructive sleep apnoea (Brouillette et al, 2000, 2001; Kheirandish-Gozal and Gozal, 2008). A systematic review concluded that topical nasal steroids improve nasal obstruction but their effect on obstructive sleep apnoea was uncertain (Kuhle et al, 2020).

Marcus et al (2013) and Fehrm et al (2020) showed that, in select populations, watchful waiting with supportive care can lead to improvement in sleep-disordered breathing symptoms and quality of life. Children on this pathway should be re-evaluated by a clinician within 6 months to monitor progress.

Mechanical devices

Mandibular advancement device

Albeit not used frequently in practice, these devices push the mandible forward and keep the tongue in an anterior position, thus increasing the diameter of the airway. There is limited evidence of their efficacy and they may be poorly tolerated, but a meta-analysis in children with uncomplicated obstructive sleep apnoea showed moderate beneficial effects (Yanyan et al, 2019).

Positive airway pressure

Positive airway pressure ventilation overnight is an option for patients with sleep-disordered breathing symptoms without adenotonsillar hypertrophy, or if the parents want to avoid surgical treatment. Preoperative continuous positive airway pressure may also be considered for a child with severe obstructive sleep apnoea (Massa et al, 2002). Continuous positive airway pressure also may have role in children with persistent obstructive sleep apnoea despite adenotonsillectomy.

Surgical: adenotonsillectomy

Adenotonsillectomy is often used as the primary surgical treatment for children with sleep-disordered breathing and is considered curative (Hartley et al, 2019). The Childhood Adenotonsillectomy Trial showed that adenotonsillectomy can be more effective than watchful waiting (Marcus et al, 2013), concluding that it had positive effects on daytime behaviour, quality of life and polysomnography findings. More recent trials have shown that adenotonsillectomy is best reserved for children with moderate sleep-disordered breathing and those with mild disease may not require surgery (Fehrm et al, 2020). If opting for surgery, caregivers must understand the risk of complications and a multidisciplinary and shared decision-making approach should be adopted. In younger populations (less than 2 years), consent should include information about postoperative respiratory complications (Saur and Brietzke, 2017; Hartley et al, 2019).

Preoperative planning

After the decision to operate has been made, the location for the operation must be considered. There has been a shift towards surgery being performed in tertiary paediatric centres, but waiting lists can be lengthy and patients may have to travel further. Planning must consider patient, surgical and anaesthetic factors, comorbidities and social circumstances (Hartley et al, 2019; Fehrm et al, 2020).

A report from a working party of the British Association for Paediatric Otolaryngology, ENT UK, the Royal College of Anaesthetists and the Association of Paediatric Anaesthetists of Great Britain and Ireland provides guidance about where children should be managed (Table 1) (Hartley et al, 2019).

Risk factors include severe cerebral palsy, achondroplasia, neuromuscular disorders, significant craniofacial abnormalities, mucopolysaccharidosis, significant cardiorespiratory comorbidity and when onsite support from tertiary medical specialities is needed (Hartley et al, 2019). Neither pulse oximetry nor polysomnography are particularly helpful in preoperative risk assessment compared with clinical predictors. Table 2 lists clinical predictors of increased risk of postoperative respiratory complications. All patients should be seen by an experienced surgeon and an anaesthetist in pre-assessment to help identify higher risk patients and appropriately plan care. If polysomnography has been performed, those with moderate to severe obstructive sleep apnoea are at increased risk of complications.

Table 1. Recommendations for the location of management of children with sleep-disordered breathing undergoing adenotonsillectomy

Recommended location	Factors
Secondary care	<ul style="list-style-type: none"> ■ >2 years of age ■ >12 kg ■ No other risk factors
Secondary care with paediatric level 2 intensive care	<ul style="list-style-type: none"> ■ >1 year of age ■ >10 kg ■ Extremes of body mass index but no other risk factors
All patients	Tertiary care with level 3 paediatric intensive care

Table 2. Clinical predictors for increased risk of postoperative respiratory complications

Age 2 years and under
Elevated body mass index
Syndromic diagnosis (eg Down syndrome, Beckwith–Wiedemann syndrome, Pierre Robin sequence)
Cardiac history
History of prematurity
History of failure to thrive
Asthma
Recent upper respiratory tract infection

From Hartley et al (2019)

Intraoperative care

The most common techniques used in the authors' tertiary unit are total (extracapsular) bipolar tonsillectomy and partial (intracapsular) coblation tonsillectomy. Adenoidectomy alone is not recommended for treating obstructive sleep apnoea in children (Marcus et al, 2012), as studies have shown that symptoms frequently persist (Nieminen et al, 1997, 2000; Kay et al, 2005).

Postoperative care and complications

Most children can be managed as a day case, ideally on a morning theatre list to allow 4–6 hours postoperative observation (Atfeh et al, 2018). Weight-based appropriate analgesia should be administered during surgery and in recovery (Atfeh et al, 2018). It is important to remember that children with severe sleep-disordered breathing are sensitive to the respiratory depressant effects of inhalational anaesthetic agents and opioids (Waters et al, 2001).

Although adenotonsillectomy is considered a safe procedure, complications occur relatively frequently, with rates of postoperative bleeding up to 10% (Marcus et al, 2013). Postoperative respiratory complications can also occur, the most common being the need for postoperative oxygen (Hartley et al, 2019). A meta-analysis estimated the rate of major complications (eg re-intubation and non-invasive ventilation) to be 5.8% (Saur and Brietzke, 2017). Most of these patients were identifiable with a clinical predictor as shown in Table 2. Younger children are at higher risk of airway and respiratory compromise as a result of the effect of postoperative oedema on their narrower airways. Most patients will make a full recovery from these complications. In some cases, there will be residual sleep-disordered breathing after adenotonsillectomy; this is more common if the underlying sleep-disordered breathing is severe (Bhattacharjee et al, 2010; Marcus et al, 2013). Ideally, children undergoing surgery should be followed up at 6–8 weeks to make sure that sleep-disordered breathing symptoms have resolved.

Conclusions

Tonsillectomy with or without adenoidectomy is one of the most commonly performed procedures in children. Increasing numbers of tonsillectomies are being performed in children between the age of 0 and 4 years. It is important that general, paediatric, surgical and anaesthetic medical practitioners understand the optimal pathway for these children. Appropriate case selection for surgery with good clinical history and direct visualisation of hypertrophied adenotonsillar tissue is a prerequisite. Attention to each patient's perioperative risk considering their age, weight, body mass index and comorbidities is important to delineate the location of surgery. Consideration of the facilities and skill mix of the staff in each unit is a critical aspect of the decision on where to operate. Surgery is successful in certain populations (ie those with moderate sleep-disordered breathing), but clinical

Key points

- Children with suspected sleep-disordered breathing should be referred to otolaryngology or a paediatric respiratory specialist.
- Sleep-disordered breathing can usually be diagnosed on clinical assessment.
- Pulse oximetry is not routinely recommended as a screening tool.
- Polysomnography should be used selectively in those with comorbidities or diagnostic uncertainty.
- Conservative management may include watchful waiting, weight loss, avoidance of allergens and treatment of allergic rhinitis.
- Continuous positive airway pressure can be offered as an alternative or in those without adenotonsillar hypertrophy or with residual sleep-disordered breathing post adenotonsillectomy.
- Surgical management with adenotonsillectomy has shown good results in paediatric sleep-disordered breathing in otherwise healthy children with adenotonsillar hypertrophy.
- Patients can be managed in secondary or tertiary centres depending on their age, weight and risk factors.

predictors of postoperative complications must be assessed, and a multidisciplinary team approach used. Future initiatives should focus on identifying the factors that predict who may benefit from surgery and experience postoperative complications.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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