Paediatric Tonsillectomy – What has the literature added in the last 5 years?

Abstract
Tonsillectomy is one of the commonest paediatric surgical procedures in the Western world. We aimed to evaluate the most recent evidence concerning paediatric tonsillectomy for the last five years.

Keywords
Tonsillectomy, Tonsillitis, Obstructive Sleep Apnoea.

Aim
- The aims of this review are to assess
  ○ to what extent recently published findings may inform and improve current practice
  ○ the persisting unanswered questions
  ○ possible methods whereby some such uncertainties might be addressed.

Methods
We searched in Medline under the MeSH heading “tonsillectomy” with “child” in the topic field, from 2007 to 2011. There were 653 references, the top categories being Surgery; Methods; Aetiology; Adverse effects and Epidemiology. Only 75 had statistical components in their sub headers. A search for “obstructive sleep apnoea” with “child” in the topic field from 2007 to 2011 yielded 848 references. We have selected the more relevant non-anecdotal papers for this review.

Tonsil surgery activity
In United States, more than 530,000 procedures are performed annually in children younger than 15 years. In Denmark, the incidence of tonsillectomy peaks at 4 years of age for both boys and girls, with 9.7 and 6.9 tonsillectomies per 1000 person-years, respectively. A second, teenage peak was higher in girls - 8.6 tonsillectomies per 1000 person-years at 16 years of age compared with only 3.1 tonsillectomies per 1000 person-years for 17-year-old boys. The finding of more tonsil disease in teenage girls replicates similar prior observations and remains unexplained. In Italy environmental factors, cultural issues and local health demands may influence indications and, therefore, the regional differences in tonsillectomy rates. In Australia the rate of adenotonsillectomy in the most recent data from 2004 stood at 6.4 per 1000. In the USA, increasing rates are due to Obstructive Sleep Apnoea (OSA). The Mayo clinic adenotonsillectomy incidence rose sharply from 243 (95% CI, 223-261) per 100,000 person-years in 1970 -74 to 485 (95% CI, 462-509) in 2000 – 05, as the proportion of patients with OSA increased from 12% to 77%. Other USA groups have confirmed these findings, noting a fall in the rate of adenotonsillectomy for infection from 2.20 per 1000 in 1996 to 1.46 per 1000 in 2006. A survey by the American Society of Paediatric Otolaryngology further identified that the proportion of obstructive indications was greatest in the youngest age groups.

While in the UK and the USA the ‘qualifying severity’ of recurrent sore throat seems to be standardised as seven sore throats in one year, five in each of two years or three in each of three years (see below), the situation appears to be somewhat different elsewhere. In Belgium, for example, an anonymous questionnaire sent to all Belgian ENT specialists found that most considered tonsillectomy to be indicated if a child or an adult suffers 3 or 4 tonsillitis episodes per year, or after a peri-tonsillar abscess. Further, surgeons became less stringent with increasing age.

It is much easier, of course to gather data on the performance of surgical procedures...
than on the background prevalence of the disease. One useful resource is the Netherlands, whose Information Network of General Practice (LINH), is a nationally representative general practice database. In 50,000 children, aged 0-17 years, registered in Dutch general practice, the incidence rates of acute otitis media, serous otitis, sinusitis, tonsillitis, and tonsil hypertrophy remained stable over the period 2002 to 2008. There was a slight decreasing trend for tonsillitis in children aged 11-17 years (RR 0.94, p < 0.001). Antibiotics were used in a minority of tonsillitis cases, with no evidence of resultant adverse consequences.9

Implications
As the surgical guidance is not evidence-based, the international variation is hardly surprising. The fall in UK surgical activity over the past 10 years is likewise mysterious. It is unclear whether it represents changes in natural history, a change in social customs, differing medical habits or the effect of financial pressures. As we have so little population baseline data we cannot be certain.

Efficacy and cost effectiveness of surgery
The RCT evidence on the outcome of tonsillectomy for recurrent sore throat is well known and fairly homogeneous - the effect seems to be the saving of a 2-3 sore throats over about two, at most three years compared with non-intervention. The Cochrane group conclusions included the following:10
- adeno-/tonsillectomy is effective in reducing the number of episodes of sore throat and days with sore throats in children,
- the gain is more marked in those most severely affected
- the size of the effect is modest
- some children get better without any surgery
- removing the tonsils will always prevent “tonsillitis”, the impact of the procedure on “sore throats” due to pharyngitis is much less predictable

The last point is particularly important – we simply do not know whether and to what extent viral sore throats are ameliorated by tonsillectomy. A great deal of effort has in the past been expended on identifying streptococcal sore throats. There is a tacit belief that those are the main justification for tonsil dissection. That may have been the case in the pre-antibiotic era, but the evidence nowadays suggests that there are many quality of life, educational and family-based drivers for surgery. Without better baseline or natural history information we cannot move guidelines or evidence forward.

The American Academy of Otolaryngology—Head and Neck Surgery (AOHNS) supports tonsillectomy for recurrent throat infection with a frequency of at least
- 7 episodes in the past year or
- 5 episodes per year for 2 years or
- 3 episodes per year for 3 years

with documentation in the medical record for each episode of sore throat and 1 or more of the following: temperature >38.3°C, cervical adenopathy, tonsillar exudate, or positive test for group A beta-haemolytic streptococcus.1 These guidelines are similar in terms of frequency to SIGN Guidance No 117, but SIGN adds the impact of sore throat on physical health and general well-being rather than this list of Centor or microbial criteria.1,12 The Centor criteria emerged from a paper analysing the probability of streptococcal infection based on four factors: tonsillar exudate, lymphadenopathy, lack of cough and history of fever. The probability of a positive streptococcal culture rose with each factor present.13

In the absence of any other guidelines, or better evidence for their modification, the North of England and Scotland Study of Tonsillectomy and Adenotonsillectomy in Children (NESSTAC), the most recent RCT published, also used the above inclusion criteria. The study has been analysed in two ways – first, the conventional intention to treat analysis.14 This concurred with the broad effects of previous RCTs – that the incidence rate ratios in years 1 and 2 were 0.70 [95% confidence interval (CI) 0.61 to 0.80] and 0.54 (95% CI 0.42 to 0.70) respectively, equating to 3.5 episodes in 2 years.

The incremental cost-effectiveness ratio was estimated as £261 per sore throat avoided. However, overall 36% of children switched out of their intended group. In particular, 26% of those randomised to conservative management switched to surgery. Also, the most and least severely affected children declined randomisation, and a model was thus created to assess the effect of surgery from the point at which it was undertaken, regardless of the initial group of random or preference allocation. Over the two years of follow-up, if tonsillectomy is performed in the first month after consultation, 9 sore throats can be saved. Where surgery is deferred for 6 months, the number of sore throats saved falls to 7 – due to the on-going improvement in the non-operative group. The as treated cost of a sore throat saved is about £154.15

Since the perception of indications for tonsillectomy is not clear cut, it is not surprising that there is poor correlation between ENT specialists and paediatricians about its use. A study of 200 children compared the views of otolaryngologists and paediatricians given the same history, and showed poor agreement about the role of surgery.16 In UK, the recently published 14-item Paediatric Throat Disorders Outcome Test discriminated well between children known to suffer with throat problems and a group of healthy controls (p < 0.0001; t = 24.016), and this questionnaire may prove a more consistent guide to surgical thresholds in future. Six months after surgical intervention, parentally reported questionnaire scores had improved with a standard effect size (i.e. change in mean divided by baseline standard deviation) of 1.53 – implying that the T14 also has a usefully high sensitivity to change.17

Implications
- The guidelines for (adeno)tonsillectomy for recurrent sore throat have become more stringent over the past decade, but remain arbitrary in the absence of better information on natural history.
- RCTs may have reached their limit of usefulness due to inherent problems of varying baseline severity, unwillingness to be randomised, lack of participant blinding, expectancy bias and uneven group switching against a background of spontaneous resolution and confounding pragmatic issues such as education and family disruption.
Paediatric Tonsillectomy – What has the literature added in the last 5 years?

- More widespread use of sensitive and specific sore throat severity tools such as the T14 across a broad population of children appears an important next step if any progress is to be made in better defining the optimum indications for surgical intervention.

Post-tonsillectomy Haemorrhage

Haemorrhage rates appear, like epistaxis, to show seasonal variation, at least in England where there is a bimodal seasonal distribution peaking in the winter and summer months, with winter rates significantly higher than spring rates (p=0.0104).18 While the UK audit readmission rate was 3.9%, the Karolinska University Hospital review in 2000-04 had a 5.5% secondary haemorrhage rate.19 The true rate of postoperative bleeding is hard to estimate – the patients are no longer a ‘captive audience’ – some may ignore minor bleeds, or take them to emergency centres where, if small they may be discharged without ENT contact. It is hard otherwise to reconcile the very large differences in international rates, particularly those in the Netherlands, where guillotine tonsillectomy, often without endotracheal intubation, remains popular. In a subgroup of 1797 patients, the primary haemorrhage rate was just under 2% but secondary haemorrhage occurred in only five patients – 0.28%. The authors concluded the ‘Sluder’ method is ideally suited to day case surgery.20 A Korean retrospective chart review of 1489 patients found a bleed rate in children of 2.5-3%.21

The USA guideline panel made a strong recommendation that clinicians should administer a single, intraoperative dose of intravenous dexamethasone to children undergoing tonsillectomy.1 Concerns that dexamethasone leads to more bleeding have been refuted.22 A 2010 Cochrane review of non-steroidal anti-inflammatory use in paediatric adenotonsillectomy found no evidence of an increased return to theatre rate for patients as a result of bleeding, comparing groups with and without NSAID use.23

The latest USA latest guideline advises clinicians who perform tonsillectomy to determine their rate of primary and secondary post-tonsillectomy haemorrhage at least annually.1 However, haemorrhage is essentially a categorical, dichotomous variable. Categorical variables, unlike continuous measures, need very large sample sizes to demonstrate meaningful effects. Thus a surgeon is very likely to find out nothing at all from such an exercise since unless he or she is worse than the average by many standard deviations, as the volume of one surgeon in one year is massively underpowered to yield helpful information. Similarly, many new technologies are introduced by enthusiasts who report their modestly sized personal series, with a message that bleeding is no greater – or marginally better than conventional methods. A steady trickle of such small papers from all parts of the globe 10-15 years ago lead to a sea change in the performance of tonsillectomy from a typically cold technique to one in which various forms of diathermy (monopolar, then bipolar and finally coblation) played an increasing prominent role. In Australia, hot techniques are now the commonest method of tonsillectomy.24

The UK Prospective tonsillectomy audit of some 33,000 operations showed that in terms of bleeding compared with the cold steel group, bipolar diathermy tonsillectomy had an odds ratio of 2.47 (1.81-3.36), p<0.0001. Use of bipolar diathermy for haemostasis only, after cold steel dissection, carried an intermediate risk, odds ratio 1.57 (1.16-2.13), p=0.004. The results confirm that “hot” tonsillectomy techniques including coblation carry a substantially elevated risk of postoperative haemorrhage when used as a dissection tool.25 More recently, a national prospective multicentre observational study in Wales reported on the main risk factors associated with postoperative haemorrhage following 17,480 tonsil procedures. Patients aged ≤12 years, and males, were at greater risk of both primary and secondary bleeds. All techniques that used heat had a significantly greater adjusted odds of secondary bleeding as compared with cold dissection, with odds ranging from 2.7 (1.5-4.7), p<0.001, for dissection plus bipolar diathermy and ties, to 13.0 (5.8-29.1), p<0.0001, for coblation when used with other techniques.26 It was noted in this paper, that the coblation technique was relatively new at the time of the study and the combination with other techniques, and the high bleed rate may have reflected a baseline on the learning curve for this technique.

Adequate analgesia post-tonsillectomy is essential in order to keep the secondary haemorrhage rate within an acceptable range.27 A study to compare analgesic regimes, however, again found a much greater impact from the type of dissection. Patients undergoing bipolar diathermy were almost six times more likely to be readmitted than those undergoing cold steel dissection (odds ratio 5.78, p<0.001).28 A retrospective study of tonsillectomy in rural areas of Australia, relying on audit data from individual units showed that the bleed rate in diathermy tonsillectomy was higher (2.4%) than with cold steel (1.85%), among the 4647 reported cases, but the relative risks were not statistically different. This retrospective reporting is open to recall bias, and the possibility that bleed rates are underestimated as the patients may present to other ENT units depending on out of hours cover.29 The amount of diathermy used may be important in the rate of haemorrhage. A prospective UK study found that while power settings did not reach significance for bleed rates when used for dissection, the use of bipolar for haemostasis following dissection resulted in significantly higher bleed rates for those using power above 18 watts (3.7%) versus less than 8 watts (1.8%) (p=0.005).30 A small USA study comparing coblation tonsillectomy pain with monopolar diathermy as the comparison group showed that coblation tonsillectomy resulted in statistically less pain than electrocautery immediately after surgery, but the difference was not judged to be clinically significant.31

Implication

- In the UK there is now a substantial body of observational data linking “hot techniques” – especially diathermy dissection and coblation – to increased secondary haemorrhage rates. These methods remain in routine use in many centres both in the UK and internationally.34 Surgeons are impressed by the minimal intra-operative blood loss and lower primary bleed rate achievable with diathermy. Personal series do not have adequate power to detect significant differences in bleed rates.

- There are genuine difficulties in case ascertainment with secondary bleeds – which presumably explain some of the national variations above.

- Until there is a substantial, i.e. adequately powered study in support of diathermy dissection and coblation, any surgeon choosing to use such methods must be able to supply evidence of his or her active
monitoring protocol to establish accurately the secondary bleed rate.

- Dexamethasone seems to offer the twin advantages of less emesis and improved pain relief and has quickly been assimilated into routine practice in many centres.

**Mortality and serious complications**

A systematic review of rare complications offers a salutary reminder of the issues that we all hope we shall continue only to read about and never encounter on 'our watch'. These include intraoperative vascular injury, subcutaneous emphysema, mediastinitis, Grisel’s syndrome (atlanto-axial subluxation), Eagle syndrome (pain related to styloid process elongation) cervical osteomyelitis, and taste disorders. It remains very difficult to assess the true risk of mortality after tonsillectomy. There are no UK national data on this topic, although word of mouth confidential information sharing suggests that the rate is not zero. The main causes of death are probably severe haemorrhage causing either shock or airway obstruction. A series from Israel suggests the rate there is far in excess of that experienced in the UK.

Life-threatening bleeding is likely to occur as a secondary event. Windfuhr collated available information, to develop prevention and management strategies, from expert reports for malpractice lawsuits or professional boards for “deaths” and “permanent generalized neurological deficiencies.” Among 43 cases, there were 32 deaths. Adenoidectomy cases were associated with immediate bleeding because of direct vascular injury resulting in one death. Tonsillectomy cases were associated with delayed and repeated episodes of bleeding resulting in 31 deaths, including 19 children. Autopsy verified predominantly aspiration and vascular injuries. Careful inspection of the nasopharynx immediately before adenoidectomy and curettage in a piecemeal fashion under visual control is helpful to prevent direct injury to aberrant arteries. Inpatient observation was strongly recommended in cases with repeated bleeding episodes. Outcome appeared to be dependent on adequate airway management. Rigid instruments and tracheotomy where intubation attempts fail were highly recommended to facilitate airway protection and ventilation. A two year German study has also recently reported from the Surveillance Unit for Rare Paediatric Erkrankungen in Deutschland; ESPED. The incidence, severity, reasons and treatment of haemorrhage were recorded over two years. During the study period, two (unforeseeable) deaths occurred - both were after adenoidectomy.

None of us can know when we may be called upon to resuscitate a child in our care. For paediatric surgical trainees APLS is a mandatory requirement for CCT. As the largest single provider of paediatric surgical interventions, most would assume the same requirement for ENT surgeons whose caseload includes children. Certainly all surgeons operating on children should have up to date resuscitation training to at least a basic level. Yet a recent survey of 17 hospitals in the London area found only 46% of operating surgeons met this standard.

A variety of training and CPD courses in resuscitation is available – for those who feel that the level of expertise demanded of the Advanced Paediatric Life Support is not for them, the Paediatric Immediate Life Support (PILS) course enables participants to understand the structured ABCDE approach that facilitates rapid recognition of seriously ill children; provide appropriate initial treatment interventions to prevent cardiorespiratory arrest and treat children in such an arrest until the arrival of a resuscitation team or more experienced assistance. The European Paediatric Life Support (EPLS) similarly encompasses early recognition of respiratory or circulatory failure; development of knowledge and core skills required to intervene to prevent further deterioration towards arrest.

**Implication**

Death after tonsillectomy is so rare that fortunately the vast majority of ENT surgeons never encounter one. But we know that the major airway complication rate can never be zero.

- The presence of a skilled and experienced anaesthetist, confident in dealing with paediatric patients, and a combination of airway and circulatory compromise, is essential
- Wherever adenotonsillar surgery is carried out, a full range of rigid laryngeal and bronchoscopes should be available, along with the equipment and ability to provide an emergency tracheostomy.
- All surgeons operating on children should have up to date resuscitation training to at least a basic level.

**Growth patterns after tonsillectomy**

Growth spurts after tonsillectomies are well recognised. Indeed children who undergo (adeno)tonsillectomy are at increased risk of becoming overweight in the years after surgery. Corresponding postoperative increases in Insulin-like growth factor-1 (IGF-1) and IGF-binding protein 3 (IGFBP-3), the latter achieving statistical significance, have also been recorded, implying a physiological rather than a sociological explanation for the phenomenon. Systematic analysis of the literature from 1970 to 2009 on patients undergoing adenotonsillectomy found nine studies which satisfied inclusion criteria. A large population of normal and overweight children undergoing tonsillectomy and adenoidectomy gained a greater than expected amount of weight postoperatively, but a larger study with consistent outcomes is needed.

**Implication**

- More work is needed on postoperative weight from demographic, metabolic and sociological perspectives.
- Some or all of such features could be included in a longitudinal, national cohort study.

**Recent observations about the role of the tonsils in other diseases which may have an inflammatory or innate immunity component**

**Asthma** Scrutiny of an asthma data base identified 93 patients who had undergone tonsillectomy in the course of their follow-up. The group showed significant improvement in postoperative asthma severity in all measures including mean hospital visits, systemic steroid administration, asthma medication use, and childhood asthma control test scores (p<0.01).
**Periodic fever** Periodic fever with aphthous stomatitis, pharyngitis, and adenitis is also known under the acronym PFAPA. Tonsillectomy (+/- adenoidectomy) is the most effective intervention for long-term resolution according to a meta-analysis of the (limited) available evidence.

**IgA nephropathy** In a select group of paediatric cases of IgA nephropathy with mild to moderate disease and recurrent tonsillitis, tonsillectomy can be a useful adjuvant treatment to improve urinary symptoms and renal function. IgA nephropathy is a common indication for tonsillectomy in Japan but is seen less often in the United States.

**Implications**
- Tonsillectomy appears to benefit a number of general paediatric problems, of which asthma is clearly the most important.
- More extensive collaborative work in other centres between paediatric otolaryngologists and chest physicians is required to see if this observation can be replicated in other centres.
- Underpinning inflammatory and microbiological basic science work may then be indicated.

**Obstructive Sleep Apnoea**
The 2009 Cochrane review of adenotonsillectomy for obstructive sleep apnoea (OSA) concluded that:

- there is on-going debate on the diagnostic criteria for significant obstructive sleep apnoea in children
- the natural history of the condition has not been fully delineated.
- there is an absence of randomised controlled trials investigating the efficacy of treatment of confirmed obstructive sleep apnoea with adenotonsillectomy in children.
- the quality of research could be improved with the use of sleep studies at baseline to determine the extent of severity of sleep apnoea in children
- long-term postoperative follow up is also required

Only research in non-intervention cohorts can address the issues of natural history and the added value of intervention over inaction. But for all practising paediatric otolaryngologists, the immediate OSA challenges remain:

- to improve the success rate of adenotonsillectomy
- to minimise risk to patients from the intervention.

**Improving the cost effectiveness of OSA surgical intervention**
Adenotonsillectomy is ostensibly being done for clinically meaningful obstructive sleep apnoea. It is inherent in the nature of outcome assessment that the tools have first to be applied at baseline. In OSA that must comprise measures of both sleep breathing disturbance and of quality of life impact, since it is well recognised that clinical estimates of OSA in children are inaccurate. Leading paediatric ENT consensus builders in both the UK and USA appear to feel that the case put to providers and policy makers for universal assessment of quantitative outcomes in OSA is a lost cause, despite the 18% failure rate for adenotonsillectomy.

The Royal College of Paediatrics and Child Health have stated that “reliable discrimination of snoring and OSA requires polysomnography”. Some support pulse oximetry as an alternative to a measure of the apnoea hypopnoea index – but this is not recommended by RCPCH, and until rigorous validation is forthcoming this can only be regarded as a poor substitute. An oximetry scoring system which was developed in Canada can be helpful in trying to quantify the severity of the apnoea, and while positive predictive values are high, negative predictive values are disappointingly low.

There is a lack of clarity in the USA guideline aimed at improving referral patterns for polysomnography in paediatric sleep disordered breathing ENT patients. The AAOHNS Foundation panel (representing anaesthesiology, pulmonology, otolaryngology-head and neck surgery, paediatrics, and sleep medicine) recommended that before determining the need for tonsillectomy, the clinician should refer children with sleep-disordered breathing for polysomnography for the following criteria:

- certain complex medical conditions such as obesity, Down’s syndrome, craniofacial abnormalities, neuromuscular disorders, sickle cell disease, or mucopolysaccharidoses
- the need for surgery is uncertain or when there is discordance between tonsillar size on physical examination and the reported severity of sleep-disordered breathing.
- severe i.e. AHI> 10 /hour or SaO2 <80%

A UK intercollegiate position paper including representation from the RCPCH, “recognised that within the UK the decision to operate on children with sleep disordered breathing is a clinical one”. Yet the same document admits that “the normal child with severe OSA is also at risk of perioperative problems but is difficult to identify”. And adds

- “children with severe OSA should be referred for further investigation”
- “it is well recognised that a proportion of children with severe OSA are acutely sensitive to anaesthetic agents”

The paradox at the centre of the management of children with clinically diagnosed OSA is that we cannot reliably differentiate the severity. Yet estimation of OSA severity is a key feature of both the American and the UK recommendation. In a sample we presume has obstructive sleep apnoea, 18% of patients may have primary snoring. A better term may be sleep disordered breathing which encompasses both primary snoring and obstructive sleep apnoea and more closely reflects the element of uncertainty in the diagnosis.

**Minimising the risk of OSA surgery**
The more severely affected children may require special monitoring postoperatively. In order to improve outcomes, there needs to be a reliable outcome measurement package. The AAOHNS guidance advises admission for overnight monitoring after tonsillectomy of children with “obstructive sleep apnoea documented on polysomnography” if they are:

- < 3 years old or
- have an AHI≥10, or
- SaO2 nadir less than 80%, or both.
Again, an unattainable gold standard unless all children are tested preoperatively.

Nonetheless, a recent practice survey concluded that “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”. While a welcome (subjective self-rated) assessment of practice, it does not address the issue that without sleep studies, cases of true OSA presenting to clinics can go undetected and untreated, and conversely that the primary snoring may be treated as if it were OSA.

While the situation where the treatment of primary snoring in the clinical diagnosis may sound unnecessary there is evidence emerging of neurobehavioral compromise caused by primary snoring alone and these children may benefit from adenotonsillectomy. The risk factors for complications after pharyngeal surgery are young age, obesity, and high preoperative apnoea-hypopnoea index. How do we define childhood obesity? In children, there is a gradual rise in BMI over the first year, then a dip, then an upward trend towards adult levels. The upward turn is called the adiposity rebound, around the age of 6 years. There are many charts and online tools to compute BMI, which can now be plotted on centile growth charts. A BMI > 85th centile is overweight; above the 95th centile, obese. It is not clear from the literature how regularly ENT surgeons in fact record BMI in paediatric clinics, yet obese children experience improvement (mean reduction of 18 in the AHI) rather than abolition of OSA.

A typical current failure rate for adenotonsillectomy in OSA is about 18%. A recent multicentre retrospective study of 578 children who underwent adenotonsillectomy with pre and post-operative polysomnography showed that only 27% had an apnoea-hypopnoea index of less than 1 and 21.6% had a post op apnoea-hypopnoea index of 5 or more. The OSA-18 has shown promise in identifying residual obstructive sleep apnoea in patients who were treated with adenotonsillectomy.

Continuous passive airway pressure (CPAP) is now suggested in children with persistent symptoms postoperatively. However, compliance and suitability of equipment remain important hurdles, especially in small children and infants. Anti-inflammatory treatments, including nasal glucocorticoids and/or the anti-leukotriene montelukast, may also offer some benefit.62

**Implication**

Neither the accurate diagnosis of true OSA, its severity nor the risks of surgery can be properly assessed on clinical criteria only.

- Risk minimisation is predicated on
  - accurate diagnosis,
  - avoidance of unnecessary surgery,
  - maintenance of life support skills and
  - appropriately targeted postoperative monitoring.
- All children need some form of review mechanism as failure may otherwise go undetected.
- ENT specialists need to be conversant with and willing routinely to apply local BMI age corrected charts in the consulting room.

**Dentoalveolar considerations in Paediatric sleep disturbance**

For many years, the assessment of adult sleep breathing disturbance has included dento-alveolar assessment alongside recording of oropharyngeal soft tissue configuration, and mandibular advancement splints or even surgical osteotomy are mainstays of therapy. Similar assessment of children is more novel. A controlled study followed 25 regularly snoring children from age 4 to 12. The snoring groups showed reduced transversal width of the maxilla and more frequently had anterior open bite and lateral cross-bite than the controls.

By age 6, 18/25 had been operated for snoring, mostly with temporary relief, but the maxillary width was still smaller by age 12, even with a patent nasal airway. However by this time there was less lateral cross-bite and the anterior open bite was resolved, in cases and controls. The children who still snored regularly at age 12 had elongated faces and were oral breathers whether operated on or not.63 If snoring persists or relapses orthodontic maxillary widening and/or functional training should be considered. Conversely, a bruxism questionnaire was used to assess 140 children aged 4 to 12 years with obstructive symptoms due to adenotonsillar hypertrophy - the prevalence of bruxism fell from > 25% before surgery to 7% thereafter.

**Implication**

- Bruxism has been shown in one study to improve after adenotonsillectomy for reasons that at not entirely clear.
- Conversely, dento-facial development in snoring children is not changed by adenotonsillar surgery regardless of symptom relief.
- Systematic detection of orthodontic anomalies and better collaboration with maxillofacial specialists, including orthodontists and/or dentists, may be helpful in treatment selection.
- If snoring persists or relapses after adenotonsillar surgery, orthodontic maxillary widening and/or functional training should be considered
- Randomized controlled trials are urgently needed to delineate their indications.

**Conclusions**

- Paediatric tonsillectomy is a more judiciously used treatment than formerly. There remain challenges however in terms of need to gather better national, full-spectrum, data on tonsil related disease.
- Better use of tonsil specific disease assessment tools may fill some of the knowledge gaps that previous attempts at randomised control trials have failed adequately to address. This form of national data collection could also be used to address unanswered questions in respect of paediatric co-morbidity and of metabolic and weight related changes which occur following surgery.
- The principal risk of paediatric tonsillectomy remains post-operative haemorrhage. Collated evidence from large numbers of patients suggests an increased rate of secondary haemorrhage with non-cold methods.
Paediatric Tonsillecory – What has the literature added in the last 5 years?

of removal. Surgeons, however, appear reluctant to implement this evidence. Some of this behaviour may result from a misunderstanding of the validity of conclusions drawn from a comparatively very small, personal series of data.

- Recent evidence suggests that ENT surgeons frequently lack appropriate paediatric resuscitation skills. This appears to be a cultural phenomenon in the UK.
- In respect of OSA, a review of the position of adenotonsillectomy and its implementation appears timely. There are many unanswered questions. What is the natural history in untreated children might otherwise have undergone tonsillecory on clinical grounds? What is the relevance of BMI in this group? Can we better predict the 18% failure rate? To what extent are dental alveolar considerations currently underestimated in non-syndrome all children with OSA? A case can be made to develop more rigorous algorithms to select children for surgery. Current guidelines appear somewhat contradictory as it is frequently implied that routine sleep evaluation, in the presence of a highly suggestive clinical history, is unnecessary. The same guidelines refer to qualifying levels of apnoea hypopnoea index for certain aspects of management, yet the index can only be used where it is measured systematically.

Key Points

- Randomised controlled trials of tonsillecory may be facilitated by new quality of life tools
- Post-operative haemorrhage correlates with “hot” surgical techniques
- Maintenance of paediatric life support skills should be a key metric of good clinical practice
- Increasingly, tonsillecory is performed for obstructive symptoms.
- Clinical examination is an unreliable predictor of obstructive sleep apnoea.
- The roles of BMI and orthodontic factors also remain to be clarified.

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Paediatric Tonsillectomy – What has the literature added in the last 5 years?


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