Chapter 24: Tonsils and adenoids

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Acute tonsillitis

This is a common disorder in children and it is unusual for a child not to have at least one or two episodes of tonsillitis. These attacks are particularly liable to occur when the child is exposed to large numbers of other children for the first time, that is on entering nursery school or primary school.

The bacteriology of acute tonsillitis and the normal flora of the throat in children is interesting and somewhat puzzling. Several studies (Box, Cleveland and Willard, 1961; Reilly et al, 1981; Toner et al, 1986) have shown that the culture of throat swabs taken from children with a history of acute tonsillitis does not differ, in terms of organisms cultured, from those taken from normal children. Box, Cleveland and Willard (1961), in a study of normal children and those with recurrent tonsillitis showed that a high proportion of normal children grow pathogenic organisms from throat swabs. In this series of normal children, 96% of swabs grew *Streptococcus pneumoniae* (pneumococcus), 50% grew *Staphylococcus aureus*, 30% grew *Haemophilus* and 5% grew a beta-haemolytic streptococcus. Similarly, a fair proportion of normal children (10% in a series from Moffett, Siegle and Doyle, 1968) will have viruses present in their throats and also anaerobic organisms (25% in the series of Reilly et al, 1981).

Doubt remains regarding the most common causative organisms in acute tonsillitis in children. It has been stated that a virus infection initiates an attack of tonsillitis and predisposes to a bacterial infection (Everett, 1979). On the other hand, a virus may be the sole agent responsible and adenoviruses, Epstein-Barr virus and herpes simplex virus have been implicated (Sprinkle and Veltri, 1976). Of the bacteria causing acute tonsillitis, beta-haemolytic streptococci, *Streptococcus pneumoniae* and *Haemophilus influenzae* are the most frequent. The role of anaerobic organisms in acute tonsillitis remains unknown at the present time.

Clinical features

The classical clinical features of acute tonsillitis are described in Volume 5, chapter 5. However, in children, particularly young children, the clinical picture may differ. For example, abdominal pain or vomiting may be more significant than sore throat and unless the throat is examined the diagnosis may be missed. Similarly, earache may be a dominant symptom in childhood and this can either be a result of an acute tonsillitis with referred pain to the ears or of coexistent acute tonsillitis and acute otitis media. Examination of the tonsils in classical acute tonsillitis shows erythematous tonsils with pus in the crypts (follicular tonsillitis). Usually there is tender enlargement of the cervical lymph nodes, particularly the jugulodigastric nodes on each side.
**Treatment**

A child with acute tonsillitis is ill and requires fluids by mouth, paracetamol in a dose of 10 mg/kg 4-6 hourly, and penicillin. The administration of the penicillin may be intravenous, intramuscular or oral. In seriously ill children the best route is intravenous (10-20 mg/kg daily). In hospital, parenteral administration is easy; in the home it is much more difficult and perhaps treatment is best initiated by intramuscular penicillin to be followed by oral dosage. If the patient is allergic to penicillin, erythromycin (25 mg/kg daily) should be used.

**Differential diagnosis**

Acute tonsillitis may occur in acute diphtheria and infectious mononucleosis and these are the two diseases most likely to be confused with an acute streptococcal tonsillitis. The differentiation is made by Gram staining of a smear made from a throat swab and by examination of a blood film. On occasions, acute leukaemia can present in childhood with a clinical picture like acute tonsillitis, but usually there is more extensive ulceration, particularly in the oral cavity.

**Complications of acute tonsillitis**

The local complications of acute tonsillitis are discussed in Volume 5 and include respiratory obstruction, peritonsillar and parapharyngeal abscess. In addition, in children, acute otitis media may occur at the same time or be a complication of acute tonsillitis as may an acute retropharyngeal abscess (see below).

The systemic or general complications of acute tonsillitis are rare and almost confined to childhood. They are discussed below.

**Septicaemia**

Untreated acute tonsillitis can result in septicaemia with septic abscesses, septic arthritis and meningitis.

**Acute rheumatic fever and glomerulonephritis**

These are diseases of unknown aetiology and follow infection with a beta-haemolytic streptococcus of Lancefield group A. The current held belief as to aetiology is that antibodies produced against the streptococcus may, in some instances, cross-react with the patient's own tissues. Thus the effect on the tissue may be an arthritis, an endocarditis or myocarditis, or a dermatitis, and in rheumatic chorea there is inflammation of the cerebral cortex and basal ganglia. In acute glomerulonephritis there is damage to the glomeruli, possibly caused by immune complexes.

The incidence of acute rheumatic fever following streptococcal tonsillitis is variable but in 1950 was of the order of 2% if the tonsillitis was not treated and 0.3% if the tonsillitis had been treated with penicillin (Denny, Wannamaker and Brink, 1950). The incidence of a second attack of rheumatic fever is approximately 60% and this is reduced to 4% if the
patient is on long-term prophylactic penicillin (sulphonamides if the patient is allergic to penicillin). Tonsillectomy does not influence the recurrence rate of rheumatic fever in patients who are given adequate prophylactic penicillin and has no place in the management of this condition.

Tonsillectomy has sometimes been advised for children who are not prepared to take antibiotic prophylaxis (Feinstein and Levitt, 1970), but this certainly does not eliminate streptococcal infections. Acute glomerulonephritis does not recur after a single attack although the effects of the attack may be long-standing. Again, tonsillectomy has not place in the management of this condition.

**Peritonsillar abscess in children**

As stated above this is a rare condition in childhood. In 1981 Holt and Tinsley reported a series of 41 children seen over a 10-year period in San Antonio, Texas. The interesting facts to emerge from this series are that only 15% of the children had a previous history of recurrent tonsillitis and this is the experience in adults with a quinsy. Of the 41 children, 11 had tonsillectomy and of the remaining children only two had a further quinsy. Here, again, it seems that the chances of having a second quinsy are not very high and certainly do not justify routine tonsillectomy.

**Acute retropharyngeal abscess**

A collection of pus in the retropharyngeal space occurs in three situations. First, and most commonly in children, it occurs as suppuration in a retropharyngeal lymph node. This is most likely to occur after an upper respiratory tract infection. The other two causes of retropharyngeal abscess are a perforating foreign body or following tuberculous disease of the cervical spine (this produces a chronic retropharyngeal abscess and is discussed in Volume 5).

**Clinical features**

Acute retropharyngeal abscess is most common in infancy and in young children (up to age of 5 years). There may have been a previous upper respiratory tract infection and the child with an abscess is pyrexial and ill. There is dysphagia with marked pain on swallowing and the patient may drool saliva. Respiration is somewhat noisy, in part as a result of accumulated secretions, but also because the abscess obstructs the airway and causes oedema of the larynx. The patient often holds his neck rigid and resists attempts to move it. There may be cervical lymphadenopathy or a very large abscess may be palpable in the neck. Examination of the child's throat is difficult, but if the posterior pharyngeal wall can be seen this is erythematous and bulging. A lateral radiograph to show the soft tissues of the neck will demonstrate an abscess, initially as an increase in the prevertebral soft tissue shadow, but later, may show an abscess with a fluid level. The dangers of a retropharyngeal abscess are airway obstruction and spread of the infective process to involve the carotid sheath laterally or the mediastinum inferiorly.

Treatment should not be delayed. The child should be started on intravenous penicillin and arrangements made to drain the abscess under general anaesthesia. This is a hazardous
general anaesthetic because intubation may be difficult and rupture of the abscess may result in inhalation of infected material into the bronchial tree. Because of these dangers, facilities should be available for emergency laryngotomy or tracheostomy. Tracheostomy may be necessary anyway to safeguard the airway postoperatively if the abscess is large. When the airway has been established the abscess should be drained. This is usually carried out by incising the posterior pharyngeal wall at the point where the abscess seems to be most prominent and breaking down all loculi with artery forceps. In a very large abscess which has extended into the neck, incision of the posterior pharyngeal wall may be insufficient and the abscess may need draining through the neck by a cervical incision and dissection medial to the anterior border of the sternomastoid muscle.

**Infectious mononucleosis in children**

Infectious mononucleosis is an uncommon but serious illness in childhood. Negative serological tests for infectious mononucleosis are more frequent in childhood than in adults, but the diagnosis is still fairly obvious from the blood film. The major complication of infectious mononucleosis in children is upper airway obstruction resulting from swelling and exudate on the adenoids, tonsil and base of the tongue and the mortality is significant. When the airway is threatened administration of steroids may avoid the need for tracheostomy, although the latter should not be delayed if respiratory obstruction is increasing. It is usual to give hydrocortisone 5 mg/kg intravenously every 6 hours.

**Diphtheria in children**

Diphtheria is now a rare disease in developed countries with an immunization programme. Two-thirds of patients with diphtheria are children and most of the deaths from the disease occur in this age group. The vast majority of patients who contract diphtheria have either not been or have been inadequately immunized.

**Diseases of the adenoids**

When considering diseases of the adenoids it is as well to remember that the mass of lymphoid tissue in the nasopharynx generally referred to as the adenoids is a normal structure with a definite function, namely the production of antibodies (IgA locally, and IgG and IgM systemically). Many consider it pedantic to insist on the singular expression, the adenoid, so the more common term, adenoids, will be used here.

The size of the adenoids varies from child to child and also in the same individual as he grows. In general, the normal adenoids attain their maximum size between the ages of 3 and 7 years and then regress. What may be important in considering the harmful effects of the adenoids is not the absolute size, but more size in relation to that of the nasopharynx. The disease processes which affect the adenoids and cause problems are infective.

An acute upper respiratory tract infection affects the adenoids and results in hyperplasia with enlargement and multiplication of the lymphoid follicles. It is certainly possible that recurrent acute infections are the sole cause of abnormally large adenoids, although it has been suggested that allergic disorders also result in adenoidal enlargement. It is likely that most of the harmful effects caused by adenoids are related to size, although is
often accepted that they may become chronically infected. There is very little evidence that 
this occurs and histological studies of adenoidal tissue very rarely show septic foci or 
microabscesses. They simply show hyperplasia of lymphoid follicles. Chronic adenoiditis is 
therefore not a proven entity and there is even less evidence for its existence as a clinical 
condition than for chronic tonsillitis. It is safest when considering diseases of the adenoids 
to limit discussion to acute infection and to chronic enlargement.

**Acute infection**

it is only relatively recently that the term acute adenotonsillitis has been used with any 
frequency, but logically it is inconceivable that the adenoids or tonsils can be acutely infected 
individually of each other. It is easier to see the tonsils during acute infection which is 
probably why the term acute tonsillitis is most commonly used, but it is almost certain that 
the adenoids are infected at the same time. Bacteriological culture of tonsils and adenoids 
removed from the same patient are very similar indeed (Polvogt and Crowe, 1929). Virus 
cultures of tonsils and adenoids yield similar results, namely adenoviruses, Epstein-Barr virus 
and herpes simplex virus (Sprinkle and Veltri, 1976).

**Enlargement of the adenoids**

As stated above it is the size of the adenoids relative to the nasopharynx that may be 
important, rather than the actual size. The effects of such enlargement produce impairment 
of nasal respiration and possible obstruction of the eustachian tube openings.

**Nasal obstruction**

There is no doubt that large adenoids can partially or totally obstruct nasal respiration 
causing snoring, hyponasal speech and forcing the child to breathe through his mouth. This 
is well documented and certainly the experience of all otolaryngologists. Unfortunately, there 
are other causes of nasal obstruction and mouth breathing, and adenoidectomy in these 
circumstances will be of no benefit. One of the sources of confusion is that a child with an 
open lip posture, that is with his lip apart at rest, is automatically assumed to be a mouth 
breather. In fact, a number of studies have shown that this is not the case and that an open lip posture may be totally unrelated to respiration. In 1969, Rasmus and Jacobs showed that 
children clinically assessed as being mouth breathers by virtue of an open lip posture had 
identical air flow studies to normal children.

Clinical examination of children with nasal obstruction is notoriously unreliable. 
Examination of the nasal cavities by anterior rhinoscopy may be normal or may show 
increased secretion, hypertrophy or congestion (hyperaemia or blueness) of the inferior turbinate. Murray (1972) showed a positive statistical correlation between enlarged adenoids 
and nasal congestion on anterior rhinoscopy, and while this association may be true in some 
children, these are precisely the appearances on anterior rhinoscopy of children with allergic rhinitis. In some children examination of the nasopharynx with a postnasal mirror will identify 
large adenoids. Unfortunately, in many children it is impossible to assess the adenoids in this 
way.
The most reliable way of assessing the size of the adenoids is to take a lateral radiograph. This will give a measure of the absolute size of the adenoids and also an assessment of the relation to the size of the airway (Hibbert and Whitehouse, 1978; Maw, Jeans and Fernando, 1981; Cohen and Konak, 1985). In an individual child with nasal obstruction, this is the best method of assessing whether adenoidectomy will improve his symptoms.

Adenoid facies

It is generally accepted that a child with enlarged adenoids has a characteristic facial appearance resulting from the effect of nasal obstruction and mouth breathing on the growth of the maxilla. This facial appearance consists of:

(1) an open lip posture with prominent upper incisor teeth and a short upper lip;

(2) a thin nose, a hypoplastic narrow maxilla, narrow upper alveolus and a high-arched palate.

These growth abnormalities result in occlusion abnormalities with cross bite and an open bite. In a very detailed and carefully performed radiological study, Linder-Aronson (1970) showed a close relationship between mouth breathing, enlargement of the adenoids and dental and maxillary abnormalities. The alternative argument is that these abnormalities of the upper jaw are, in fact, inherited variations of the normal (Tulley, 19640. It is possible that normal-sized adenoids in an inherited hypoplastic maxilla will give rise to symptoms, whereas this would not occur in a normal maxilla. A causal relationship between enlarged adenoids and maxillary abnormality has never been demonstrated.

Effect of the adenoids on the ear

The classical concept is that enlargement of the adenoids, possibly in association with infection, results in an increased incidence of acute otitis media and of non-suppurative otitis media (glue ear). It has been demonstrated both by radiological techniques (Bluestone, 1971) and by pressure studies (Bluestone, 1975a, b) that the adenoids can mechanically obstruct the eustachian openings and that adenoidectomy relieves the obstruction. The alternative view is that the adenoids may be responsible for recurrent otitis media and otitis media with effusion in only a small proportion of children. If the adenoids are solely responsible, it is difficult to explain the occurrence of ear problems in children with small adenoids, and in those whose adenoids have been removed. Unfortunately, controlled studies of ear disease and adenoidectomy have not resolved this question. In general, the controlled studies have shown that adenoidectomy has little effect on the occurrence of acute otitis media (Rynnel-Dagloo, Ahlbom and Schiratzki, 1978). Two controlled studies have shown some benefit for adenoidectomy in children with otitis media with effusion (Maw, 1983; Bulman, Brook and Berry, 1984) and other studies have shown no benefit (Rynnel-Dagloo, Ahlboom and Schiratzki, 1978; Fiellau-Nicholajsen, Falbe-Hansen and Knudstrup, 1980; Roydhouse, 1980; Widemar et al, 1986). Further discussion of the aetiology of otitis media with effusion is presented in Chapter 12.
Sleep apnoea

The condition known as sleep apnoea was first described by Gastaut, Tassinari and Duron in 1966, and is characterized by apnoeic episodes during sleep associated with hypersomnolence during the day. In normal children brief episodes of apnoea occur during sleep and definition of the abnormal is difficult. This has been arbitrarily chosen as at least 30 episodes of apnoea lasting 10 seconds or more during 6 hours of sleep. Pathological episodes are associated with hypoxaemia and bradycardia which do not occur in normal children (Tilkian et al, 1976).

Apnoeic episodes may be obstructive, central or mixed. Obstructive apnoea is when increasing respiratory effort produces no airflow; central apnoea occurs when respiratory effort ceases and the defect is in the central control mechanism, either in the brainstem or chemoreceptors, or connections of these. The otolaryngologist is concerned with obstructive apnoea and the role that enlargement of the tonsils and adenoids plays in its aetiology. Luke et al (1966) reported a series of children who had developed right ventricular failure and pulmonary oedema. These complications were felt to be related to upper airway obstruction and were completely relieved by tonsillectomy and adenoidectomy in three children and by adenoidectomy in one. Since then a number of reports have confirmed that adenoidectomy alone or combined with tonsillectomy will reverse upper airway obstruction which has caused pulmonary hypertension and right-sided heart failure. In 1977, Mangat, Orr and Smith showed that obstructive apnoea during sleep could be cured by adenoidectomy. Similarly, it has been shown and documented by polysomnography that tonsillectomy and adenoidectomy will improve obstructive apnoea and oxygen desaturation in children (Eliaaschar et al, 1980; Mauer, Staats and Olsen, 1983).

The current theory regarding obstructive sleep apnoea is that if untreated, apart from the problems of daytime sleepiness, a proportion of these children will go on to develop pulmonary hypertension and cor pulmonale. The prevalence of pathological sleep apnoea is unknown and the risks of development of cor pulmonale as a result are also unknown and remain to be investigated. These risks must be very small because the number of children who develop cor pulmonale with otherwise normal hearts and respiratory system is low.

The recognition of sleep apnoea clinically and its treatment are difficult problems. It is surprising how many parents, when questioned about snoring in children, will volunteer the information that as well as snoring their children have apnoeic episodes which, quite naturally, alarm the parents considerably. Clinical examination may confirm noisy respiration even when the child is awake and examination of the throat may show very large tonsils. However, in most children the diagnosis is not nearly so easy to make. Radiology with a soft tissue lateral view may show totally obstructive adenoids and observation in hospital may confirm or refute the diagnosis of sleep apnoea.

Ideally, these children should be monitored during sleep with electrocardiography, strain gauges for chest movement and ear lobe oximetry for oxygen saturation recording. Unfortunately, the facilities for such recordings are rare and in the vast majority of centres observation by nurses and resident medical staff may be all that is available. Such observations, however, is essential to avoid unnecessary and wholesale surgery. Once it has been demonstrated that a child has significant obstructive sleep apnoea and that other
conditions such as micrognathia or Treacher Collins syndrome are not responsible, the question still remains as to whether the child should have adenoïdectomy alone or whether the tonsils should also be removed. Most authorities in this field favour the combined operation as being the most expedient way of solving the problem. An alternative approach is to assess the size of the adenoids by radiology, and if indeed they are totally obstructing the nasopharynx, then perhaps it is reasonable to perform adenoïdectomy alone. This is the author's practice, but it must be admitted that a proportion of children subsequently need tonsillectomy to solve the problem.

**Tonsillectomy and adenoïdectomy**

In the past and sadly, even at the present time, the reasons for subjecting a child to 'Ts and As' (the mere title implies a lack of thought and care) have been and are less than rigid. Large numbers of operations are performed each year and it is the responsibility of every surgeon to be certain that every one of these operations is performed for the correct indications. There is some evidence that the number of operations has been reduced over the last 20 years. In 1963 there were around 200,000 operations per annum in the UK (Tate, 1963). The DHSS statistics on hospital inpatients show that between 70,000 and 90,000 tonsillectomies and/or adenoïdectomies have been performed every year in England and Wales between 1978 and 1983. These figures refer to children treated in National Health hospitals. The figures are greater if one includes adults undergoing tonsillectomy and a large number of operations performed in private nursing homes.

The indications for performing this operation, both in general and on every occasion it is done, need to be rigorously examined. The morbidity and mortality associated with such surgery in childhood are not to be taken lightly and thus we are negligent if the operation is performed without very strict indications. Some of the reasons advocated for tonsillectomy and adenoïdectomy in the past are plainly ridiculous and it is embarrassing to read them in medical literature. Ideally, an objective way of evaluating the problem is needed before advising any surgical procedure. The more that a surgical procedure relies upon subjectivity either in the patient or the doctor, the less likely is the efficacy of that procedure. In fact, tonsillectomy in particular is the prime example of a surgical procedure the performance of which depends upon the subjective assessment of the parents of the child and, to a lesser extent, of the general practitioner.

Clinical examination is unlikely to be a decisive factor in the assessment of a child for tonsillectomy. Certainly clinical assessment of the size of the tonsils is not particularly reliable and the size is not related to the severity of previous infection (Weir, 1972). Cervical lymphadenopathy is probably related to recurrent tonsillitis and it has been shown that children with a history of tonsillitis are more likely to have large palpable glands in the neck than normal children (Mills and Hibbert, 1983). However, this is a very imprecise method of assessment and 75% of normal children have palpable cervical lymph nodes.

It is most unlikely that bacteriological examination of throat swabs will cast any light on the assessment of children with recurrent tonsillitis. Serological tests have been explored as a possible indicator of recurrent or chronic infection and a report by Veltri et al (1972) seemed to be encouraging. In this study elevated levels of IgG and IgA were found in a small group of children with recurrent tonsillitis or recurrent otitis media. After tonsillectomy and
adenoidectomy these levels returned to normal. However, Kerr, Basuttil and Mandell (1977), could not substantiate these findings and found no differences in IgM, IgA or IgG levels in children undergoing tonsillectomy compared with normal individuals. Even if there are changes in immunoglobulins produced by recurrent tonsillitis, these are almost certainly fairly non-specific and unlikely to be a major contribution to the decision of whether or not to remove the tonsils.

We are therefore left with a history of recurrent tonsillitis as the main method of assessing children for tonsillectomy. Based on this history a number of clinical trials have been designed to evaluate tonsillectomy. At the present time five such controlled trials have been published (Kaiser, 1930; McKee, 1963; Mawson, Adlington and Evans, 1968; Roydhouse, 1970; Paradise, 1983), the last one of which is not yet complete. The control patients in these trials are those who, although thought to need operation, have not had surgery and so they are compared with the operated children. Unfortunately, the assessment of the children after surgery is necessarily subjective and therefore the bias introduced by the placebo effect of surgery is not eliminated. This fundamental drawback in such trials is inevitable, the only way round this problem being unethical and not possible, namely the performance of sham operations (that is, the child is anaesthetized but no surgery is performed), and even this would not be blind because it would be obvious which children had had surgery and which had not. Despite this limitation, these trials are of value and, particularly in the case of the Pittsburgh Children's Hospital study, some interesting and relevant facts have been produced.

From the Pittsburgh study it became obvious that a history of recurrent sore throats did not mean that these continued. In fact, of children with a history of recurrent episodes of tonsillitis only 17% continued to have such episodes when supervised and examined at regular intervals by a team of doctors and nurses (Paradise et al, 1978). Since the history of recurrent episodes were quite rigorous (five to seven a year for 2 years), most of these children, if seen by an otolaryngologist, would have been advised to have surgery. If these figure are representative it means that based on history, 80% of tonsillectomies are unnecessary and that we are performing five times as many as are needed. The second fact which has so far emerged from this study is that tonsillectomy does reduce the incidence of sore throats when compared with control children with a similar history of repeated episodes of acute tonsillitis. However, the problems encountered by the control children (that is non-operated children) were not excessive and many of the sore throats which they suffered were classified as mild. This implies that the benefits bestowed by tonsillectomy were not necessarily great, even if it did mean tonsillitis was eliminated.

In many studies, tonsillectomy and adenoidectomy are considered together. This is completely erroneous. Removal of the tonsils and adenoids should be regarded as entirely separate procedures with separate indications. On occasions both tonsils and adenoids will need to be removed but this should not apply to both simply because there are indications that one of these organs needs to be removed. It has been erroneously assumed, with no scientific basis, that if one of these structures is infected or enlarged then the other is inevitably similarly diseased. This is not true; the size of the adenoids in no way relates to the size of the tonsils in a given child (Stearns, 1983). Similarly, it has been felt that if one of these structures is removed then the other will undergo hypertrophy and give rise to problems. In fact, as long ago as 1962, Young showed that in children who had undergone adenoidectomy
a further 12% would need tonsillectomy. Looked at another way, if these children had undergone 'Ts and As' instead of adenoidectomy alone, 90% of them would have had an unnecessary tonsillectomy. On occasions indications will exist for both tonsillectomy and adenoidectomy but this should not be a thoughtless ritual.

**Indications for tonsillectomy**

**Recurrent episodes of acute tonsillitis**

All children will have one or more episodes of acute tonsillitis and this is not abnormal. A series of many attacks in childhood is unusual and there is no doubt that these can be avoided by tonsillectomy. This has advantages in that if it is possible to prevent these attacks education is not harmed and if a child can be saved these illnesses it is an advantage. It is unlikely that there are any long-term sequelae from recurrent tonsillitis and serious complications of tonsillitis are unusual (*see above*) in the present day because of antibiotics. There is no evidence that recurrent tonsillitis affects growth (Mills and Hibbert, 1983).

When an otolaryngologist sees a child with a history of recurrent acute tonsillitis, a diagnosis possibly supported by examination during acute episodes by the general practitioner and defined as severe illness, pyrexia, dysphagia, lasting at least 5 days, he is asked to predict whether these attacks are going to continue or whether they will cease spontaneously. If it is felt that they are likely to continue then tonsillectomy is reasonable. It is this prediction which is so difficult. However, it is assumed that if a child has had six attacks of genuine tonsillitis per year for at least 2 years then they are likely to continue. This, therefore, is our prime indication for tonsillectomy and doubt is cast even on this by the Pittsburgh Children's Hospital study. It is important to determine that the attacks of sore throat are those of tonsillitis and not an upper respiratory tract virus infection - the latter possibly associated with coryza and usually a shorter-lived infection. If there is doubt the patient can be seen during an acute episode. If the history is questionable then the patient should be reassessed 6 months later. It is surprising how this will reduce parental anxiety and very often avoid the need for surgery.

Tonsillectomy should never be used as a means of placating anxious parents when the indications are not present. On the other hand, parental anxiety is to be respected and can be allayed by careful and sympathetic history taking and examination of the child.

**Peritonsillar abscess**

As discussed above, quinsies are rare in childhood and the recurrence rate is of the order of 20%. Probably, in the most unlikely event of a child having a recurrent quinsy, tonsillectomy is indicated to prevent further episodes.

**Sleep apnoea**

Although this is a condition which needs to be evaluated it does seem that a number of children have obstructive sleep apnoea which is cured by tonsillectomy and adenoidectomy.
Contraindications to tonsillectomy

Recent upper respiratory tract infection

A recent upper respiratory tract infection is an absolute contraindication to tonsillectomy and the operation should be postponed for 3 weeks. Primary and secondary haemorrhage are considered to be more likely if an acutely inflamed tonsil is removed. Pulmonary complications of anaesthesia are more likely when the child has an upper respiratory tract infection.

Bleeding

It is essential when considering a child for tonsillectomy that a history of bleeding in the patient or family is excluded. If there is any such history the child must be fully investigated and if a bleeding disorder is discovered the indications for surgery must be reviewed and avoided if at all possible.

If, however, the reasons for surgery are compelling (this must be very rare) then the coagulation deficit must be corrected before surgery.

Cleft palate

A child who has had a cleft palate repair has an abnormal soft palate. Tonsillectomy will result in further scarring of the soft palate and may adversely affect speech. For this reason it should be avoided if at all possible.

The operation of tonsillectomy

The important points about the surgical techniques of tonsillectomy are discussed in the adult in Volume 5 and will not be repeated here. The essential difference in the technique is that, in the child, an oral endotracheal tube is present. This must be positioned centrally on the dorsum of the tongue and fixed in this position in the slot of the Doughty blade of a Boyle-Davis gag. Unless the tongue is carefully positioned before surgery access to one tonsil will be totally inadequate. It is essential to choose the correct size of Doughty blade. In the average child aged 6 or 7 years a 9 cm (3.5 inch) blade will be found to be appropriate. The cross bar at the tip of a blade which is too small will compress and obstruct the orotracheal anaesthetic tube. A small blade will also allow the base of the tongue to obstruct the view of the lower parts of the tonsillar fossae and make adequate tonsillectomy impossible.

It goes without saying that the blood volume of a child is less than that of an adult and this is an important consideration when performing surgery in children. The average blood loss during a routine tonsillectomy and adenoidectomy is between 100 and 130 mL (Shalom, 1964; Holden and Maher, 1965). If the blood volume of a child is calculated as 75 mL/kg this means that a child weighing 13 kg or less will lose nearly 14% of its blood volume in an uncomplicated procedure; 14% is the point of blood loss in a child at which transfusion is felt to be necessary (Editorial, 1965). Excessive bleeding, postoperative bleeding or preoperative anaemia thus assume great importance in the child, particularly the young
child. The blood loss during tonsillectomy should be measured so that excessive loss can be documented and corrected.

The postoperative care of a child undergoing tonsillectomy is of critical importance. The position immediately following extubation should be such that if any bleeding does occur the blood will run out of the mouth and nose and not into an unprotected larynx. Thus the child should lie on his side with his head below the level of the shoulders.

The postoperative observations include regular recording of the pulse rate (every 15 minutes for the first 2 hours, every 30 minutes for the next 2 hours and hourly thereafter) and close observation of the child's breathing pattern. A semiconscious child with blood in the pharynx will always make an audible noise on respiration and this should also be an indication to examine the child's pharynx for haemorrhage. Excessive swallowing or vomiting of blood is a sign that bleeding has occurred and here again the pharynx should be examined. Postoperative sedation should be avoided in children either as a routine or to quieten a restless child because it may well mask haemorrhage. The presence of the parents is the best of calming an anxious child. Analgesia should be adequate without being excessive and there is little indication for narcotic analgesics. Paracetamol (250–500 mg) as an oral suspension depending on the age of the child is usually sufficient. Aspirin should be avoided as it increases the risk of primary haemorrhage (Carrick, 1984) by reducing the platelet adhesiveness and prolonging the bleeding time. The administration of aspirin has been incriminated in the causation of Reye's syndrome and its use is contraindicated in children under 12 years of age. The vast majority of children can be discharged home 24 hours after tonsillectomy without increasing the risk of haemorrhage (Siodlak, Gleeson and Wengraf, 1985).

Complications of tonsillectomy

These are fully discussed in Volume 5 and will not be restated in detail here. Clearly the most important factor and the cause of most of the deaths associated with tonsillectomy is haemorrhage and the delay in treating it. Tate (1963) investigated the cause of death in 93 children over a 5-year period and stated that this delay was the primary cause of death following tonsillectomy. The death rate was approximately one child per 10,000 operations. The factors which make the operation more serious in a child than an adult are the relative blood volumes, the difficulty in recognition of haemorrhage in children and the problems in coping with it in an uncooperative child. If there is thought to be haemorrhage in a child following tonsillectomy, blood should be prepared for cross-matching and the child should be prepared for anaesthesia. A minor bleed may occur which ceases after a few minutes and, in this situation, a child should be observed very closely with regular inspection of the tonsillar fossae. There is no place for sedation in the treatment of haemorrhage and the idea that this would quieten a restless child and stop the bleeding is not logical. Any child bleeding significantly after tonsillectomy should be re-anaesthetized and the bleeding point dealt with. This second anaesthetic is hazardous (Davies, 1964) and should only be administered by a very experienced anaesthetist.

The psychological effects of operation are likely to be more harmful in children than in adults. In 1945 Levy presented the results of a study of children with behavioural disorders and reached the conclusion that most of these were precipitated by an operation (tonsillectomy
and adenoidectomy being the most common). Levy et al (1967) made a number of recommendations to avoid undue psychological trauma:

(1) postponement of surgery if at all possible until the age of 3 years;
(2) an explanation of what is going to happen should be given to the child;
(3) the child should be with a parent immediately before and after surgery;
(4) the child should be adequately sedated before leaving the ward.

**Indications for adenoidectomy**

**Nasal obstruction**

Children who have an obstructed nasal airway should be evaluated by clinical examination and by radiography. If the latter shows the airway to be obstructed by the adenoids then adenoidectomy is indicated.

**Otitis media with effusion**

The evidence that the adenoids are a causative factor in otitis media with effusion is equivocal and was discussed previously. Some surgeons advocate adenoidectomy as primary treatment for otitis media with effusion, either alone or combined with insertion of ventilation tubes. Other surgeons advise the insertion of ventilation tubes possibly reserving adenoidectomy for children whose effusion recurs after extrusion of the tubes. A third approach is to advise insertion of ventilation tubes as primary treatment, only removing the adenoids if they are large.

**Recurrent acute otitis media**

Although historically adenoidectomy has been advised to prevent recurrent attacks of acute otitis media there is no evidence that it is effective.

**Sleep apnoea**

As discussed above either adenoidectomy alone or combined with tonsillectomy is valuable in the treatment of obstructive sleep apnoea.

**Contraindications to adenoidectomy**

**Recent upper respiratory tract infection**

A recent upper respiratory tract infection is an absolute contraindication to adenoidectomy.
Bleeding

As with tonsillectomy, a suspected bleeding disorder must be investigated before adenoidectomy.

Cleft palate

As discussed in the complications, in certain instances the adenoids assist the soft palate in closure of the nasopharynx from the oropharynx during speech and deglutition, and removal of the adenoids may impair speech. The adenoids should never be removed in a child who has had a cleft palate repair, one who has a congenitally short palate or in one who has a submucous cleft of the palate.

The operation of adenoidectomy

This operation is by no means a minor procedure. Far from being an afterthought following tonsillectomy it should be regarded as a major surgical procedure with significant risks and complications. For example 60-70% of the blood loss during tonsillectomy and adenoidectomy and control of excessive bleeding following adenoidectomy is more difficult than after tonsillectomy.

The preoperative considerations and preparation of a child for adenoidectomy are identical to those for tonsillectomy. The anaesthesia is also the same using an orotracheal tube which is stabilized in a Doughty blade using a Boyle-Davis gag.

When performing tonsillectomy and adenoidectomy it is usual to extend the neck of the patient using a sandbag under the shoulders of the child. This accentuates the curvature of the cervical spine and probably makes a complete adenoidectomy more difficult. A more neutral position of the neck, neither flexed nor extended may be preferable.

The adenoids are palpated with an index finger and it is important that the soft palate is relaxed during this manoeuvre or it will be torn. It is usual to dissect, using the finger, the lateral extension of the adenoids towards the midline. A St Clair Thomson curette is then inserted into the nasopharynx, gently positioned against the posterior surface of the nasal septum and swept downwards. It is important to select the curette of the correct size. Too large a curette will damage the eustachian cushions and one which is too small will mean that the adenoidectomy is incomplete. As the main mass of adenoids has been curetted, the blade of the curette is brought forwards to avoid running it down the posterior pharyngeal wall and stripping the mucosa. On occasions the adenoid mass remains attached by mucosal strands inferiorly. These should be avulsed using Luc's forceps, but the direction of avulsion should be cranial, otherwise the mucosa of the posterior pharyngeal wall will be stripped. The nasopharynx is palpated and any adenoidal remnants are curetted. A pack is then placed in the nasopharynx to help haemostasis. Modifications of this adenoidectomy technique are numerous. Inspection of the nasopharynx with a mirror and removal of remnants of lymphoid tissue have been advocated (Sheridan, 1951). A fundamentally different approach is direct adenoidectomy in which the soft palate is retracted and the adenoids removed under direct vision using punches forceps and scissors (Guggenheim, 1957).
If bleeding continues after removal of the pack a second pack should be inserted and left for a further 5 minutes. If bleeding still continues mirror examination of the nasopharynx may reveal a bleeding point which can be cauterized or an adenoid tag which can be removed. If at this point bleeding continues some surgeons will resort to the use of topical adrenaline (1:1000) on a swab and others will insert a postnasal pack to remain for 24 hours. There must be absolutely no bleeding from the nasopharynx before anaesthesia is terminated.

The complications of adenoidectomy

The possible complications of adenoidectomy are basically the same as for tonsillectomy and will not be considered here in detail. However, there are certain other considerations associated with adenoidectomy.

Excessive haemorrhage

Occasionally there will be excessive haemorrhage at adenoidectomy. Aberrant vessels have been described (Grant, 1944; Duncan, 1963) and occasionally an aberrant internal carotid artery has been damaged at surgery (Harmer, 1914; McKenzie and Woolf, 1959). In general, excessive haemorrhage should be investigated by coagulation studies, blood should be replaced and the haemorrhage corrected by diathermy if possible or with a postnasal pack. Postoperative bleeding from the adenoidal bed is serious and the child should be returned to theatre immediately and a postnasal pack inserted.

Surgical trauma

The soft palate, particularly if it is not relaxed, can be damaged during adenoidectomy. The eustachian cushions can be injured and stenosis can occur (see below). Dislocation of the cervical spine has been described (Gibb, 1969) but usually this is caused by infection affecting the anterior ligaments of the spine and resulting in subluxation of the atlanto-occipital joint about 10 days after surgery.

Effect of adenoidectomy on speech

Children with large obstructive adenoids may have hyponasal speech, that is the speech of nasal obstruction and one would expect this to be improved following adenoidectomy. Hypernasal speech following adenoidectomy has been estimated to occur once every 1450 operations (Gibb, 1958). This is almost certainly a lower figure than the actual incidence because less severe cases may be overlooked or may be only temporary. The reason for hypernasality (nasal escape speech like that with cleft palate) following adenoidectomy is that the adenoids assist the soft palate in closing the nasopharynx during speech. Hypernasality is therefore more likely to occur postoperatively in those children with an abnormal soft palate. This may be congenitally short or its musculature may be defective in a patient with a submucosal cleft. The latter is associated with a bifid uvula and a notch in the hard palate, and adenoidectomy should be avoided in this situation. If the above obvious examples of palatal abnormality are excluded only a small number of children should develop hypernasality following surgery and one would expect these to be only temporary and to respond to speech therapy.
Scarring following surgery

It is not unusual to see fibrous bands or adhesions in the nasopharynx following adenoidectomy and normally this will cause no harm. Trauma to the eustachian openings may well produce stenosis and may impair eustachian tube opening and this has been suggested as one of the causes of failure of adenoidectomy to cure ear symptoms. Rarely, adenoidectomy results in total obliteration of the nasopharynx by scar tissue.

Persistence of symptoms following surgery

It is not unusual for symptoms to persist following adenoidectomy. Dawes (1970) has stated that 70% of children in his series with serous otitis had previously had an adenoidectomy. There are three possible explanations for this:

(1) the adenoid was not responsible for the symptoms in the first place;

(2) postoperative scarring, particularly of the eustachian openings nullifies any benefit of surgery;

(3) lymphoid tissue left in the nasopharynx following incomplete adenoidectomy results in symptoms. Much has been made of adenoid remnants causing symptoms and the proponents of direct adenoidectomy use it to justify their approach. There is no doubt that some lymphoid tissue must remain in the nasopharynx following adenoidectomy and on occasions this tissue can undergo hypertrophy and cause symptoms. This is probably rare and may be more likely to happen when the child having adenoidectomy is very young.