

Tonsillitis and sore throat in children

Abstract

Surgery of the tonsils is still one of the most frequent procedures during childhood. Due to a series of fatal outcomes after hemorrhage in children in Austria in 2006, the standards and indications for tonsillectomy have slowly changed in Germany. However, no national guidelines exist and the frequency of tonsil surgery varies across the country. In some districts eight times more children were tonsillectomized than in others. A tonsillectomy in children under six years should only be done if the child suffers from recurrent acute bacterial tonsillitis. In all other cases (i.e. hyperplasia of the tonsils) the low risk partial tonsillectomy should be the first line therapy. Postoperative pain and the risk of hemorrhage are much lower in partial tonsillectomy (=tonsillotomy). No matter whether the tonsillotomy is done by laser, radiofrequency, shaver, coblation, bipolar scissor or Colorado needle, as long as the crypts are kept open and some tonsil tissue is left behind. Total *extracapsular* tonsillectomy is still indicated in severely affected children with recurrent infections of the tonsils, allergy to antibiotics, PFAPA syndrome (periodic fever, aphthous stomatitis, pharyngitis, and cervical adenitis) and peritonsillar abscess. With regard to the frequency and seriousness of the recurrent tonsillitis the indication for tonsillectomy in children is justified if 7 or more well-documented, clinically important, adequately treated episodes of throat infection occur in the preceding year, or 5 or more of such episodes occur in each of the 2 preceding years (according to the paradise criteria). Diagnosis of acute tonsillitis is clinical, but sometimes it is hard to distinguish viral from bacterial infections. Rapid antigen testing has a very low sensitivity in the diagnosis of bacterial tonsillitis and swabs are highly sensitive but take a long time. In all microbiological tests the treating physician has to keep in mind, that most of the bacteria, viruses and fungi belong to the healthy flora and do no harm. Ten percent of healthy children even bear *streptococcus pyogenes* all the time in the tonsils with no clinical signs. In these children decolonization is not necessary. Therefore, microbiological screening tests in children without symptoms are senseless and do not justify an antibiotic treatment (which is sometimes postulated by the kindergartens).

The acute tonsillitis should be treated with steroids (e.g. dexamethasone), NSAIDs (e.g. ibuprofene) and betalactam antibiotics (e.g. penicillin or cefuroxime). With respect to the symptom reduction and primary healing the short-term late-generation antibiotic therapy (azithromycin, clarithromycin or cephalosporine for three to five days) is comparable to the long-term penicilline therapy. There is no difference in the course of healing, recurrence or microbiological resistance between the short-term penicilline therapy and the standard ten days therapy.

On the other hand, only the ten days antibiotic therapy has proven to be effective in the prevention of rheumatic fever and glomerulonephritic diseases. The incidence of rheumatic heart disease is currently 0.5 per 100,000 children of school age.

The main morbidity after tonsillectomy is pain and the late haemorrhage. Posttonsillectomy bleeding can occur till the whole wound is completely healed, which is normally after three weeks. Life-threatening haemorrhages occur often after smaller bleedings, which can spontaneously cease. That is why every haemorrhage, even the smallest, has to be treated properly and in ward. Patients and parents have to be informed

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about the correct behaviour in case of haemorrhage with a written consent before the surgery.

The handout should contain important addresses, phone numbers and contact persons. Almost all cases of fatal outcome after tonsillectomy were due to false management of haemorrhage. Haemorrhage in small children can be especially life-threatening because of the lower blood volume and the danger of aspiration with asphyxia. A massive haemorrhage is an extreme challenge for every paramedic or emergency doctor because of the difficult airway management. Intubation is only possible with appropriate inflexible suction tubes.

All different surgical techniques have the risk of haemorrhage and even the best surgeon will experience a postoperative haemorrhage. The lowest risk of haemorrhage is after cold dissection with ligature or suturing. All "hot" techniques with laser, radiofrequency, coblation, mono- or bipolar forceps have a higher risk of late haemorrhage.

Children with a hereditary coagulopathy have a higher risk of haemorrhage. It is possible, that these children were not identified before surgery. Therefore it is recommended by the Society of paediatrics, anaesthesia and ENT, that a standardised questionnaire should be answered by the parents before tonsillectomy and adenoidectomy. This 17-point-checklist questionnaire is more sensitive and easier to perform than a screening with blood tests (e.g. INR and PTT). Unfortunately, a lot of surgeons still screen the children preoperatively by coagulative blood tests, although these tests are inappropriate and incapable of detecting the von Willebrand disease, which is the most frequent coagulopathy in Europe.

The preoperative information about the surgery should be done with the child and the parents in a calm and objective atmosphere with a written consent. A copy of the consent with the signature of the surgeon and both custodial parents has to be handed out to the parents.

Keywords: tonsillitis, tonsillectomy, intracapsular, extracapsular, antibiotics

Introduction and terminology

Importance of the tonsils in childhood and anatomical structure

The tonsils serve immune acquisition and immune defence by antigen presentation, which is why they contain T-lymphocytes, macrophages and germinal centres of B-lymphocytes [234]. They are the first and easiest-to-reach station of the mucosa associated lymphoid tissue system (MALT) in humans [25], [26], [147]. Since the main phase of the immune acquisition continues until the age of 6, the *palatine tonsils* are physiologically hyperplastic at this time [117], [157]. Then there is an involution, which is reflected mostly in a regression until the age of 12 [116]. The lymphatic tissue is separated by a more or less rough capsule from the surrounding muscle (superior pharyngeal constrictor) [159]. The palatine tonsils have a strong blood flow from four different vessels, the *lingual artery*, the *ascending pharyngeal artery* and the *ascending* and *descending palatine arteries*. These vessels radiate mainly to the upper and lower tonsil pole, as well as the exact centre of the tonsils laterally [234]. The tonsils have deep crypts to keep the organ surface as large as possible

and to create a docking surface for potential antigens [60]. The crypts and their adjacent germinal centres are separated from each other by delicate connective tissue [132], [158] (Figure 1, Figure 2).

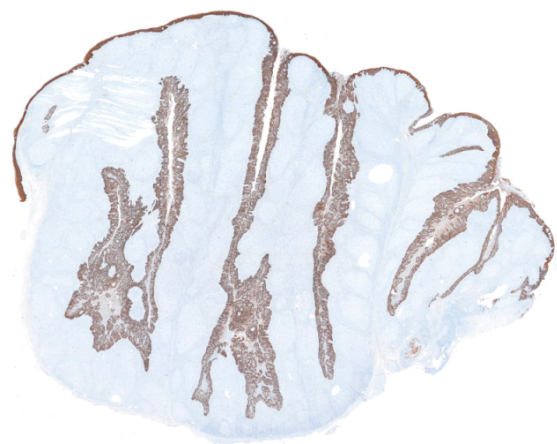


Figure 1: Specimen of a tonsil in keratine colouring after extracapsular tonsillectomy (10-year-old child). The long crypts with keratine on the surface are well-defined. (with kind permission of the pathologic institute at LMU, Prof. Ihrler)

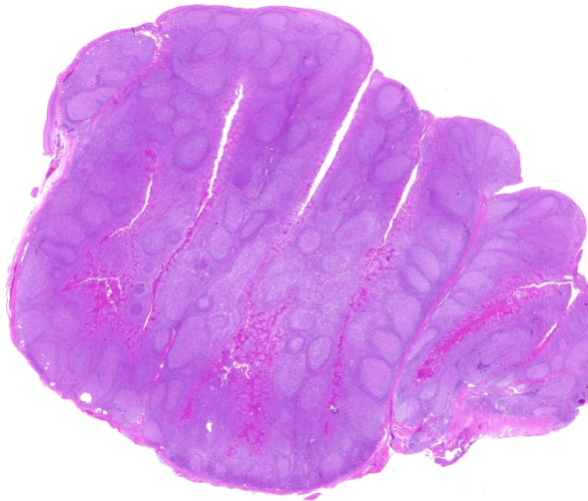


Figure 2: HE-Colouring of the same tonsil with many lymph follicles (with kind permission of the pathologic institute at LMU, Prof. Ihrler)

Current facts about tonsil surgery

Currently, in Germany every year 48 of 10,000 children and adolescents undergo tonsillectomies, so that we are ranked in 3rd place among the OECD countries. This intervention is the most common inpatient surgery in childhood and adolescence under anaesthesia and the most common service of ENT departments in Germany. While in recent years the rate of complete tonsillectomies during childhood in Europe has decreased (see Figure 3), from 1970 to 2005 it has increased constantly in the U.S. from 13.7 to 15.3 per 10,000 children [64]. However, the indication for tonsillectomy has moved away from the recurrent tonsillitis towards the child's obstructive sleep apnoea (OSA) [22]. Due to the accumulation of deaths following tonsil operations in children in 2006 in Austria, the Austrian Societies of Otorhinolaryngology and Pediatric Medicine fundamentally revised their indications for tonsillectomy in childhood and recommend a tonsillectomy in children under 6 years only in exceptional cases [150]. Especially for tonsillar hyperplasia with pediatric OSA, the much less dangerous and less painful partial removal of the tonsil (tonsillotomy) is to be preferred. Scherer et al. already indicated this development in Germany with extreme caution in 1994 [194]. Five years later, Hultcrantz and Linder from Sweden [103], [136] and then again in 2002 Scherer and Helling published the first results of laser tonsillotomy [92]. At that time, the complete, extracapsular tonsillectomy was the only accepted method [153] and this initially brought the authors plenty of ridicule in the professional societies. In fact, the partial tonsillectomy is not a new method [71]. Until the development of general endotracheal anaesthesia all tonsils were actually only partially removed because an extracapsular tonsillectomy was technically not possible [62]. Meanwhile, the tonsillotomy has been rediscovered with modern methods (laser, radiofrequency, ultrasound), and in different countries in recent years similar guidelines have been published as in Austria with

clear recommendations for partial removal of the tonsils [9], [14], [150], [169], [228]. A German S3-guideline was announced in 2008, but its completion has been postponed, as it is apparently difficult to reach interdisciplinary consensus. Hard facts for the years 2007–2010 on the incidence of tonsillectomy in childhood (1 to 19 years) for Germany are provided by the Bertelsmann Foundation at <https://mandeloperation.faktencheck-gesundheit.de>. There are very large regional differences: In some districts, eight times as many children have the tonsils removed as in the others. The authors of the Bertelsmann Foundation thereby see a connection between the local care by ENT inpatient and main departments (the higher the ENT department density, the more frequent the tonsillectomy) and the absence of clear guidelines in Germany. A closer look at the study, however, is striking in that for the three largest cities (Berlin: 27, Hamburg: 40, Munich: 33 per 10,000 children), despite their high density of ENT main departments, the number of tonsillectomies is significantly below the national average of 48 per 10,000 children. The authors conclude that in smaller ENT-departments the tonsillectomy, despite the comparatively low eff. cost weight of 0.44 (inpatient department) and 0.70 (main department, Source: DRG Grouper the University of Münster), is an important economic factor (Figure 4).

Terminology and ICD10 Classification

One problem with comparison of different studies is the different and imprecise terminology. This is evident not only in different countries and different languages, but also within the German literature various terms are called synonymous or different. The following definitions correspond to the majority (teaching) opinion and are used consistently within this paper as such:

Acute tonsillitis (J03.0 - J03.9)

English synonyms: severe tonsillitis [127], true tonsillitis, acute sore throat [81]; refers to a viral or bacterial tonsillitis withodynophagia, swelling and redness of the tonsils, possibly with tonsillar exudate, cervical lymphadenopathy and fever $>38.3^{\circ}\text{C}$ rectal [150], [213]. Anodynophagia for 24 to 48 hours, as part of prodromal symptoms of a common cold due to viral infection of the upper respiratory tract, is excluded from the definition of "acute tonsillitis" [81].

Depending on the stage and appearance of the deposits, or the exudate on the tonsils, one can distinguish the catarrhal angina with redness and swelling of the tonsils (early stage) from the follicular angina with stipple-like fibrin deposits from the lacunar angina with confluent deposits (late stage) [18], [19]. The diagnosis of "acute tonsillitis" can be made purely clinical by a specialist [213]. Smears, blood tests or viral evidence is not necessary in most cases [24], [76], [126], [212], [213].

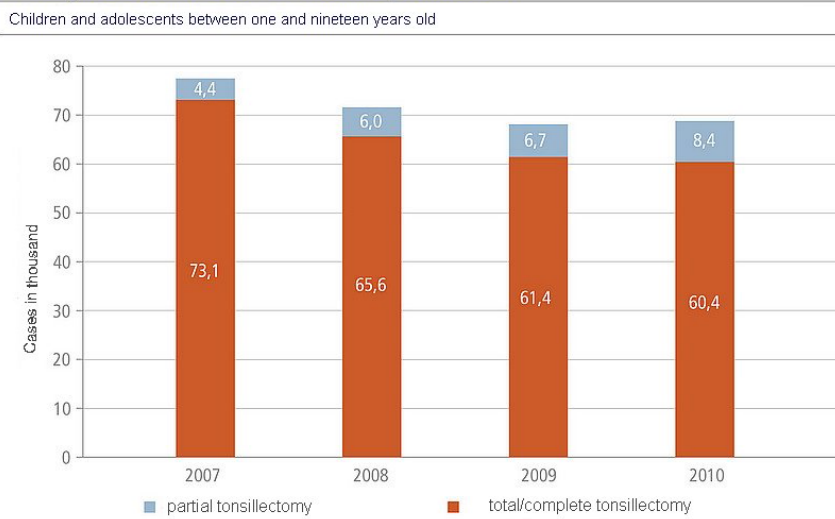
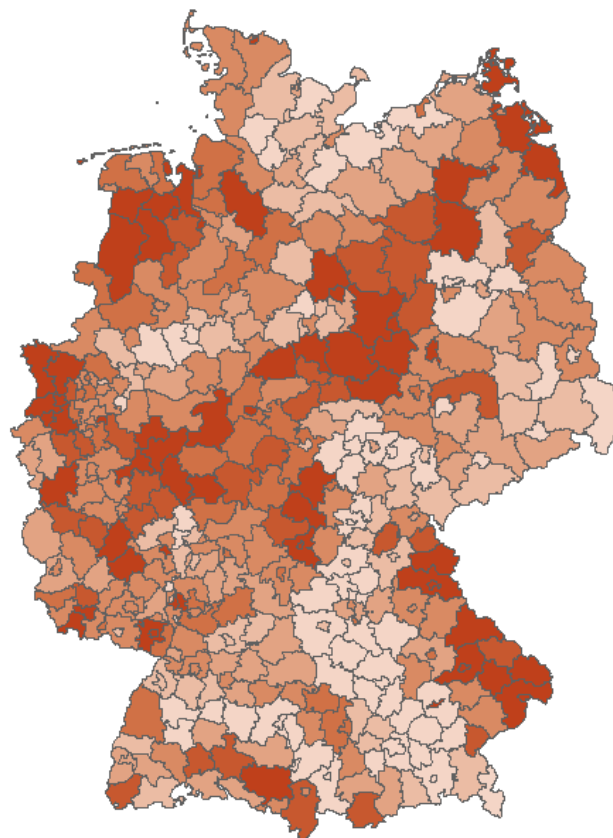


Figure 3: Complete and partial resections of the tonsil in children and adolescents in the year 2007 to 2010 as inhouse procedures

(from: <https://mandeloperation.faktencheck-gesundheit.de/fachinformation/ursachen-und-hintergruende/>)



Tonsillectomies per 10.000 children and adolescents in different german districts

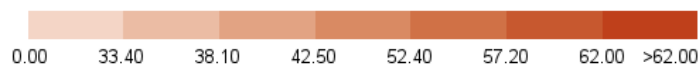


Figure 4: Number of children (max. 19 years old) who underwent tonsillectomy per year, pertained to 10,000 children per district. In some districts only 14/10,000 were tonsillectomized, in other districts 109.

Source: Faktencheck Gesundheit 2013, Calculation by IG ES, Daten Destatis, Bundesamt für Kartographie und Geodäsie

Chronic tonsillitis (J35.0 and J35.9)

English synonyms: chronic (hyperplastic) tonsillitis; although this term yields 1287 hits within a Medline search, it is unclear and misleading and should not be used [213]. Similarly, the term “Chronic tonsillitis with acute exacerbation”. Here, it seems likely that it is a chronic change in the tonsils with phased acute deterioration [221]. It is better to speak in such cases of (chronic) recurrent tonsillitis [29], [213], because there exists no real *chronic* tonsillitis with consistent symptoms for more than 4 weeks under adequate treatment and reconstruction of the mucosa (as in rhinosinusitis).

Acute recurrent tonsillitis (J35.0)

English synonyms: recurrent tonsillitis, recurrent throat infections [80]; refers to recurrences of acute tonsillitis. These are, in contrast to a single attack of acute tonsillitis, usually caused by many different bacterial pathogens [107], [216] and flare up again a few weeks after cessation of an antibiotic therapy [108]. Depending on the frequency and severity of such episodes, there is an indication for tonsillectomy.

Peritonsillar abscess (J36)

English synonyms: peritonsillitis; peritonsillar abscess; quinsy [75], [171]; called an acute tonsillitis with formation of an abscess, typically on one side [50]. The abscess may form in the intratonsillar, para-/peritonsillar or retrotonsillar spaces. The pathogens are typically staphylococci [121], streptococci and fusobacterium necrophorum [119]. In contrast to acute tonsillitis, viruses play no role in an abscess [182].

Tonsil hyperplasia (J35.1 and J35.3)

English synonyms: tonsillar hyperplasia [172], (idiopathic) tonsillar hypertrophy [198]; refers to the abnormal enlargement of the palatal tonsils. This is to be distinguished from the physiological pediatric palatine tonsil hyperplasia [83], [157]. The pediatric tonsil hyperplasia is not a sign or consequence of recurrent inflammation [66], [172]. Also, children with tonsillar hyperplasia do not suffer with an above average frequency of acute tonsillitis [93], [208] or middle ear infections [27]. A pediatric tonsil is only “pathologically” hyperplastic if one of the cardinal symptoms occur, namely rhinopathy (with or without OSA), rarely dysphagia⁸⁴ and even more rarely dysphonia [73].

Sore throat episodes (R07.0)

English synonyms: acute sore throat, throat infection; here it must be addressed in the context of the international literature, since there are over 16,000 articles, which deal with the unclear and imprecise term. The problem is that the term “sore throat” clinically does not distinguish between acute tonsillitis and pharyngitis. Thus, neither the cause nor the exact location must be determined [81]. Some authors (including the often cited paper by Paradise, JL [153]) distinguish between “severely affected throat infections” and “moderately affected throat infections” [155]. It still remains unclear whether it is an acute (bacterial) tonsillitis, which however is solely the basis of the indication for tonsillectomy [152].

Tonsillectomy (OPS 2013: 5-281.0)

English synonyms: (extracapsular) tonsillectomy; means that the entire tonsil, including its capsule and possibly also parts of the palatal arch, are removed from the tonsillar fossa. There is no longer any lymphatic tissue between the anterior and posterior palatal arch [1]. Since the late 1960s, with the discovery of the tonsil as a focus of infection [69], [70], [170], [231], this form of tonsil operation is recognized as the gold standard in the fields and is still cited as the most common surgery in the world [224] (Figure 5).

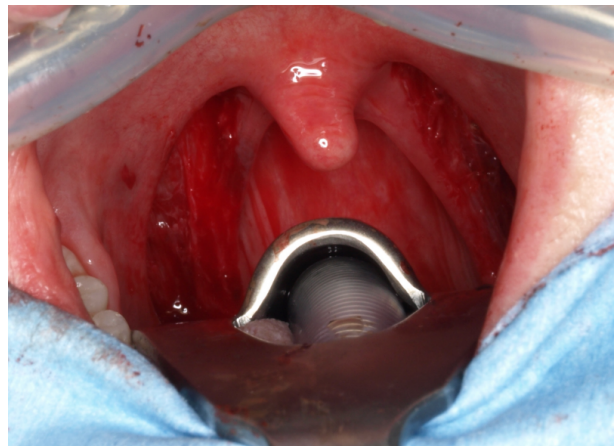


Figure 5: Intraoperative image after extracapsular tonsillectomy on both sides. Bare muscle fibers are apparent. Hemostasis was achieved by swap compression and punctual bipolarization.

Tonsillotomy (5-281.5)

English synonyms: partial tonsillectomy, tonsillotomy, means that only the medial portions of the tonsils are removed. This requires that the (well perfused) lymphatic tissues be severed, and the remaining crypts must remain open to the oropharynx [123], [194]. Active lymphatic tissue, with secondary follicles and crypts, remains in the tonsillar fossa on both sides [172] (Figure 6).

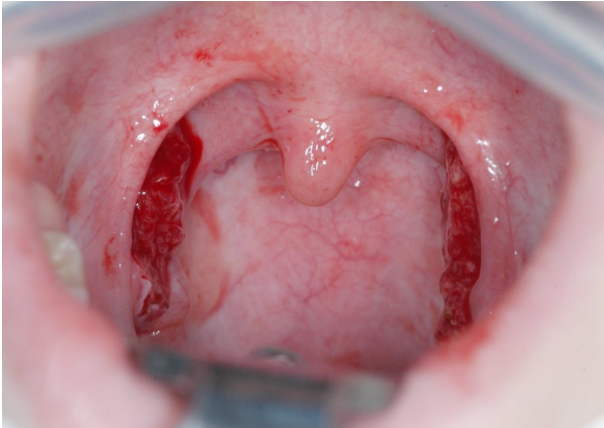


Figure 6: Intraoperative image after partial removal of the tonsils on both sides with radiofrequency current

Intracapsular tonsillectomy (5-281.0)

English synonyms: intracapsular/subcapsular or subtotal tonsillectomy; describes a method in which the lymphatic active tissue of the tonsil, including all crypts and follicles, is removed [32], [68]. However, the capsule of the tonsil is not broken and thus the underlying muscles are not exposed [59]. At the end of the operation there is an empty tonsillar fossa without the typical scarring [8]. A closer look at the literature, however, is striking that the intracapsular tonsillectomy is partially equated with tonsillotomy [36], [45], [102], [105], [122], [230] (Figure 7).



Figure 7: Postoperative image of the left side 3 months after intracapsular tonsillectomy

Cryptolysis (5-289.0)

Describes a procedure in which the tonsil tissue ring is laid bare around the crypt superficially and the crypt shrinks in the course. The lymphatic active tissue remains present and still intact. Most authors state that this intervention is to be performed on an outpatient basis under local anaesthesia and with the CO₂ or diode laser or radiofrequency current [35], [49], [72], [124], [156]. Indications should be tonsil stones or foetor from the mouth.

Thermal or cryotherapy of the palatine tonsils (5-289.00 to 5-289.04)

Synonyms, or techniques: interstitial (electro)coagulation to the palatine tonsils, laser coagulation, thermal coagulation, cryocoagulation [4], [166], photodynamic therapy, ultrasound therapy [37], radiofrequency-induced thermotherapy [160], temperature-controlled tonsil treatment [47], [249], tonsil thermotherapy; means that the tonsil tissue defined interstitially is heated (or cooled) and then scarring subsequently results in shrinkage of the lymphatic tissue. Most authors see the indications with hyperplastic tonsils. No tissue is removed and a large part of the lymphatic tissue remains allegedly functional.

In principle, the interstitial thermotherapy is possible with all high frequency, radiofrequency or laser systems in the coagulation mode [162]. Most systems can however also cut and thus dissect the tonsil tissue. A laser or high frequency current therapy of the palatine tonsils can mean everything from the complete tonsillectomy to interstitial thermotherapy. In particular, the terms “tonsillotomy”, “cryptolysis” and “radiofrequency-induced/laser tonsil surgery” are often used interchangeably. Therefore, the material and methods section of the respective papers then have to be searched to determine exactly which type of therapy has been performed.

Conservative treatment measures and diagnostics

Pathogen spectrum, biofilms, normal findings

The findings on the responsible germs, especially in the chronic recurrent tonsillitis, have changed in recent years due to increasingly better detection methods [3], [40], [58], [107], [177], [216], [221]. While with the discovery of rheumatic fever, primarily the group A streptococci (GAS) were blamed for all the ills in the upper respiratory tract in the seventies [5], [63], [69], [70], [142], [170], [210], [231], recently there are anaerobes, such as *Fusobacterium necrophorum*, *Streptococcus intermedius* and *Prevotella melaninogenica* and *histicola* [107], [119], [120]. Few modern works illuminate the pathogen spectrum in the tonsils precisely. Swidsinski and Lochs from the Charité in 2007 examined the pathogens of the tonsil in various stages of tonsillar life at times more precisely [216]. They found that children up to 8 years of age have a tendency towards a diffuse, intracellular pathogen enrichment with interstitial abscesses, while they could prove in adults or adolescents a more superficial bacterial accumulation at the edge of the crypts. Particularly in the case of recurrent tonsillitis, several pathogens and microorganisms play a role together. These are jointly able to form biofilms and bacteria clusters and thus evade antibiotic therapy [168]. The oral cavity and especially the furrowed tonsil is a reservoir for multiple pathogens

(viruses and bacteria), parasites [146] and fungi [144]. However, all these microbes belong to the transient flora and we live in symbiosis with them for aeons [107], [195]. Jensen A. et al. were able to detect more than 100 bacteria in the tonsils of children and adults with and without recurrent tonsillitis. 52 different bacterial strains from the basis were detectable in each patient, whether child or adult, whether sick or healthy. These represent 90% of the total pathogen load [107].

It almost seems that nearly all pathogens are detectable in the sick, but also healthy tonsils with the proper detection method. In acute tonsillitis, tonsil hyperplasia or chronic recurrent tonsillitis obviously there is a change only in the ratio in favour of some pathogenic germs [107]. In the clinically acute tonsillitis in childhood the streptococci still play the largest role with 30% [28], followed by *Haemophilus influenzae* and *Neisseria* [107]. Mostly, however, mixed infections (viral and bacterial initially) are responsible for the clinical picture [167] (Figure 8).

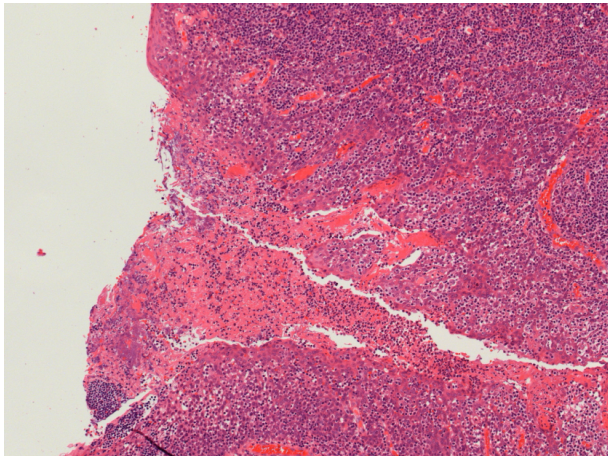


Figure 8: Open crypt after tonsillectomy with radiofrequency dissection. In the debris of the crypts dwell multiple microbes and fungi. The child suffered not from recurrent tonsillitis or infections, but had only a tonsillar hyperplasia. (with kind permission of the pathologic institute at LMU, Prof. Ihrler)

Diagnosis

The diagnosis of “acute tonsillitis” in children and adults can be made on purely clinical signs by a specialist [213]. Whereby it concerns mostly mixed infections (viral and bacterial) [167]. In viral tonsillitis, in addition to pain and fever, primarily cough, hoarseness, and rhinorrhoea occur, while in bacterial tonsillitis, in addition to pain with lymph node swelling, there are mainly tonsillar deposits/exudate and fever $>38.3^{\circ}\text{C}$ [150]. A streptococcal antigen test can confirm the diagnosis and is specific to 98% for streptococci, although not particularly sensitive. Therefore, the manufacturers recommend that in the event of a negative test result, several tests should be performed in a row. The tests are simple, fast (10 min) and cheap (25 tests for 35.- Eur). Since the tests are freely available, concerned parents also come with positive or negative test results and demand (antibiotic) therapy from the ENT

doctor. One problem with these tests is the high number of asymptomatic chronic carriers (10% of healthy children) of staphylococci and streptococci, who are definitely not in need of therapy [112], [113], [177], [219], [218], [233]. Smears or bacterial and viral RNA rapid tests should therefore be performed only on symptomatic children who are not yet classified [200]. In the early stage, the distinction between viral and bacterial tonsillitis is often difficult to make. Especially when one considers that in 97.5% of cases, at least one virus, even in the bacterial tonsillitis, is found (adenovirus and parainfluenza virus respectively in 47.5% of the cases [59], [161]) [167]. These viruses appear, however, as does the Epstein Barr virus in the pharyngeal tonsil [16], [115], often be clinically occult. Thus, screening by using rapid tests (such as required by some kindergartens or schools) does not make sense because a lot of false-positive results are found [200], [201]. The same may apply to the antistreptolysin titre, which rises completely non-specifically in streptococcal infections that have occurred and then increases over many years [200].

Antibiotic therapy

Chris Del Mar from Queensland, Australia, has worked with the Cochrane Institute for many years on the exact analysis of the effectiveness of antibiotic therapy for throat pain (sore throat) and acute tonsillitis [52], [53], [54], [149]. During the revision of its most recent meta-analysis of 2010, the authors outlined a total of seven usable studies with children under 18 years old [54]. In clinically definite or proven bacterial tonsillitis associated with distress, antibiotic therapy using a beta-lactam antibiotic is justified. It shortens the course of the disease by an average of one day. Antibiotics reduce the fever and reduce pain compared to placebo, most clearly on the third day after administration. In addition, a beta-lactam antibiotic therapy provides relatively reliable protection against the dreaded rheumatic fever and glomerulonephritis, which often leads especially in third world countries to arthritis, myocarditis and death. Some studies have shown that antibiotic therapy can prevent sequelae such as peritonsillar abscesses, acute otitis and sinusitis. Also, a recent Cochrane analysis from 2013 showed the effectiveness of different antibiotics in acute (streptococcal) tonsillitis [226]. The penicilline, in particular in children and adolescents, show the greatest benefit at the lowest cost. There were no differences to cephalosporines. Cephalosporines are, however, more effective in children under 12 years of age and for chronic recurrent tonsillitis, as they can eradicate more strains of streptococci [31]. Macrolides and clindamycin in children evoke more side effects with the same efficacy and therefore should be reserved only for proven penicilline allergy sufferers [38], [39].

One advantage of modern macrolide antibiotics is a significantly shorter duration of treatment, which should increase compliance. As before, the duration of the recommended standard therapy with penicillines for acute

streptococcal infection is 10 days [39], [118], [169]. With regard to the reduction of the course of the disease and the reduction of the symptoms, the short-term therapy with azithromycin (20 mg/kg) [46] for three days or clarithromycin and cephalosporin for five days is equal to the long-term penicillin therapy with better compliance [6], [7]. Also, the early discontinuation of penicilline after five days showed no disadvantages in the disease process, the rate of recurrence or the development of resistance [82]. Only the low-dose azithromycin (10 mg/kg) administration is not recommended because a significantly higher relapse rate could be demonstrated [7]. However, not considered in the short-term antibiotic therapies are the late complications of rheumatic fever and glomerulonephritis, which however are among the main arguments for a long-term beta-lactam antibiotic therapy for acute streptococcal tonsillitis, although the incidence of rheumatic fever in Europe is reported at only 0.5 cases per 100,000 children of school age [7]. A general postoperative antibiotic therapy does not make sense because it reduces neither the pain nor lowers the postoperative bleeding rate [2], [56].

Supportive therapy

Steroids

Oral or intramuscular steroids in children and adolescents also show a significant improvement in symptoms with minimal side effects and no negative effects on disease progression [89], [90], [91]. The best results were seen in proven streptococcal pharyngitis for dexamethasone (10 mg), as well as betamethasone (8 mg) and prednisolone (60 mg) with a clear reduction in the pain and feeling of illness, both in acute tonsillitis, and pharyngitis or sore throat [91].

Analgesics

Non-steroidal anti-inflammatory drugs have been used successfully for pain relief in children for over 40 years [145]. For acute tonsillitis, among the over-the-counter substances ibuprofene shows the highest efficacy with minimal side effects compared with paracetamol and acetylsalicylic acid (ASA) [225]. Another advantage of ibuprofen is longer duration of action of 6-8 hours in contrast to paracetamol. The therapeutic range of both substances is large and at the correct dosage, the safety potential is comparable [87], [88]. However, in the case of overdose with paracetamol, the liver damage is much harder to treat. In comparison, ASA shows significantly more gastrointestinal side effects and should not be used for acute tonsillitis with possible subsequent tonsillectomy due to the pronounced inhibition of platelet aggregation [138].

Diclofenac and ketorolac in children have fewer docking sites and are metabolized more quickly, which is why the dose should be adjusted (higher dosage than in adults) [74]. In the postoperative management these substances

play a certain role in opioid conservation, but as first-line therapy in paediatrics they are not suitable for a sore throat [178], [179]. Metamizol is not recommended as an analgesic of the first or second choice in children due to the small but existing risk of agranulocytosis in the world literature [12].

Mouthwashes, phytotherapy, lozenges, Roeder method

Antiseptic mouthwashes with chlorhexidine or benzydamine have been tested in a study from Turkey (double-blind and placebo-controlled) and showed symptom improvement there in children and adults. Further studies are absolutely necessary to sufficiently prove efficacy [41], [42].

Typical herbal gargles contain sage, thyme and chamomile. They lubricate and maintain the mucous membranes. However, many contain ethanol as an extraction solvent and are not approved for children <12 years old [43]. Bionorica AG, Neumarkt, has received marketing approval for many herbal medicines for children and adults. Imupret® coated tablets or drops are suitable for tonsillitis. These are approved for children from 2 years and older and are intended to act as a 7-part combination anti-inflammatory and immunomodulatory [17]. Another herbal product of the company for children is Tonsipret®. It contains capsaicin, lignum vitae and pokeweed in homeopathic doses. Reliable clinical trials, however, were not found on homeopathy for acute tonsillitis.

Nasturtium and horseradish root are contained in Angocin® tablets from REPHA GmbH Biological Pharmaceuticals, Langenhagen. Both plants are said to have antimicrobial, antiviral and antifungal effects [43]. Pelargonium sidoides (EPs 7630), known as Umckaloabo from South Africa, is marketed in Germany for children and was able to show a significant symptom improvement compared to placebo in a clinical trial in children with sore throat (no proven streptococcal pharyngitis) [15]. No side effects were recorded [111]. In some studies, herbal formulas of traditional Chinese medicine have shown significant advantages or even superiority over antibiotics. However, not all these studies were GCP-compliant and not all have undergone a recent systematic review of their status [98]. Lozenges containing benzocaine numb the oral mucosa and are often offered in combination with Sialorheologica (Lemocin® Forte, Dobendan Strepsils®). The increased flow of saliva acts as a disinfectant, maintains the mucous membranes and accelerates the healing process [43]. These lozenges are, like all homeopathic and most herbal medicines, OTC medicines, i.e. sold only in pharmacies, but not refundable and usually for children 2 years and older.

In his book "The Natural Tonsil Treatment" of 1918, Roeder describes a method that is used more often today than earlier in many ENT practices. The detritus-filled tonsils are suctioned with a glass suction cup, thereby removing the debris and massaging the tonsils at the same time, which (according to the current viewpoint)

promotes lymphatic drainage [140]. Then the tonsils are brushed or sprayed with disinfectant solutions. However, this method is more difficult to apply in children because the suction procedure is quite painful.

Differential diagnoses

Often hidden behind pediatric tonsil hyperplasias, with or without recurrent infections, is a chronic nasal respiration obstruction or a chronic mouth breathing. In turbinate hyperplasia or deviated septum the cold, unfiltered, dry air flows past the tonsils, causes physical irritation, dries out the mucous membranes and maintains infections [21]. Furthermore, an allergy must be considered in principle with a chronic inflammation of the mucous membranes of the upper respiratory tract [183]. In particular, dust mite and mould allergy sufferers tend all year round (with peaks in winter) to experience infections of the tonsils and upper respiratory tract [114].

Another cause of recurrent tonsillitis is tooth decay [79]. Chronic mouth breathing and recurrent tonsillitis promote periodontal disease and tooth decay. Conversely, the (partial) tonsil removal can positively affect periodontal disease and even the complete pediatric dental state [55].

Especially with unilateral tonsillar hyperplasia, the differential diagnosis of lymphoma must be considered, particularly if unilateral lymph node swelling, reduced performance and fatigue occur [20].

Unilateral tonsillitis in children also allows as a differential diagnosis a Plaut-Vincent angina (first described by Plaut and Vincent (1894)) or a mucosal aphth. In the latter, pain is in the foreground, with only minimal visible results, while the Plaut-Vincent angina, caused by the spirochete *Treponema vincentii* and fusiform *Fusobacterium (Fusobacterium nucleatum)* manifests as large, dirty, one-sided deposits, but causes hardly any pain and only minimal restrictions of the general condition [78].

Scarlet fever (A38) and mononucleosis (B27)

In acute tonsillitis two common subdiagnoses are highlighted: scarlet fever and the primary infection with the Epstein Barr virus (mononucleosis).

Scarlet fever is caused by group A streptococci (primarily *Streptococcus pyogenes*). These must have a specific bacteriophage, which is responsible for the production of the scarlet fever erythrogenic toxin. When the toxin enters the skin, it results in the typical rash for scarlet fever [130]. Without this it is only a purulent tonsillitis. There are several serotypes of this bacteriophage, each of which can cause the disease. Therefore, people can fall ill repeatedly with scarlet fever in the course of life [174]. The contamination is caused by droplet infection and contact via the mouth and throat. The tonsils show the typical fibrin stippling and the tongue is coated white at first, later the coating comes off and the tongue appears shiny red with protruding taste buds (strawberry or

raspberry tongue). After one to four days, the characteristic rash is dense with pinhead-sized, red-coloured spots. Preferred sites are the armpits, the groin and the cheeks, while the mouth-chin-triangle remains free (perioral pallor or *milk mustache*). About 14 days after starting, it frequently results in a characteristic scaling of the skin on the finger or toe crests or even on the entire palms and soles of the feet. Scarlet fever responds very well to oral penicillin and can (as so often with pediatric diseases) range from a mild feeling of illness with sore throat to severe courses with fever, malaise, confinement to bed and exsiccosis [174].

Mononucleosis (synonyms: Pfeiffer fever, monocytic angina, Pfeiffer's disease, students fever or kissing disease) is caused by the Epstein-Barr virus. Approximately 95 percent of Europeans under 30 years of age are infected with the virus. Especially in children under ten years old, the disease is often without symptoms; in the elderly usually flu-like signs of disease occur. Sometimes in adolescents it occurs as a severe course with severe sore throat and swollen, coated tonsils and large lymph nodes. Furthermore, splenic enlargement, loss of appetite, chills, dry cough, nausea and night sweats can occur [229]. In general, the disease occurs only once in one's life, but as with other herpes viruses, the Epstein-Barr virus remains in the body for life and can be intermittently activated again (often incorrectly referred to as re-infection). It is transmitted by exchange of saliva (kissing disease) [100]. Simple coughing is not usually sufficient. Prolonged disease processes, extending in a weakened form sometimes over months and years, are rare. The Epstein-Barr virus can, as many other viruses also, trigger post-viral fatigue syndrome in adults. Such fatigue syndromes must be treated supportively (balanced diet, if necessary, nutritional supplements, no competitive sports, regular sleep). The therapy in the acute state consists of bed rest, adequate fluids and antipyretic drugs. Antibiotic therapy only makes sense with bacterial superinfection (in 10% of cases). Therefore, ampicilline and amoxicilline should not be used for therapy, as these in up to 90 percent of cases can lead to the formation of a rash (ampicillin exanthema) and pruritus. This rash may occur even after taking the antibiotic and usually requires about three days to fully spread across the body [229]. A tonsillectomy à chaud produces no benefit or shortening of the disease with a significantly increased postoperative bleeding risk [238]. It is indicated only in case of a complication (peritonsillar abscess, dyspnoea due to large tonsils) [34]. Currently, there is still no approved vaccine for the Epstein Barr virus, but several working groups are researching on it [44], [181].

Complications

In general, acute tonsillitis runs its course without complications and heals within three to four days. Rare but serious complications after strep tonsillitis are the glomerulonephritis and rheumatic fever, which triggers cardiomyopathies and rheumatic-like joint pain [69]. Early and

long-lasting (10 days) antibiotic therapy with penicilline or cephalosporins can reduce the frequency of both these complications by 70% [54]. In areas of the third world where rheumatic fever is more common, the prevention of this complication is the main argument in favour of penicilline therapy [54]. In Europe, the probability of rheumatic fever is so low that of twelve general practitioners only one will ever experience a new onset case [97]. A second, more frequent complication is peritonsillar abscess. This typically occurs on one side. But acute tonsillitis leads the way only in one third of cases [196]. Even the correctly performed antibiotic treatment of acute tonsillitis cannot really prevent peritonsillar abscess (in contrast to rheumatic fever) [164]. Since peritonsillar abscess is a potentially life-threatening situation and can rapidly spread to the neck soft tissues, the primary therapy in children and adults is urgent and surgical [94], [165], [196]. Whether the abscess is needle aspirated, incised or treated by tonsillectomy does not matter [165]. Before the operation, a high-dose steroid therapy, as well as penicillin and metronidazole should be administered, as is often done for mixed infections [165]. In only about 30% of cases after a peritonsillar abscess in children is there a relative indication for tonsillectomy in the interval [93] either because a renewed abscess occurs or because tonsillitis reoccurs. The postoperative bleeding risk is lower with the abscess tonsillectomy on the abscess side than on the opposite side, so with peritonsillar abscess in children a bilateral tonsillectomy à chaud must be discouraged [239]. If these children suffer recurrent tonsillitis in addition to the peritonsillar abscess, it must be considered whether the increased risk of bleeding from the tonsillectomy à chaud can be accepted in order to prevent a possible second intervention in the infection-free interval.

Indications for surgery

Paradise criteria and guidelines in Europe

Austria, Italy, Croatia, the United States, Canada, the Netherlands and England have issued clear recommendations for tonsillectomy in their Guidelines [14], [133], [169], [176], [211], [228]. The Austrians and Dutch recommend tonsillectomy in children under 6 years old only in exceptional cases, otherwise the tonsillotomy is to be preferred due to a significantly lower risk. Interestingly, the Anglo-American countries did not mention the tonsillotomy at all and for tonsil hyperplasia with childhood OSA they see the complete removal of the tonsils as continuing to be indicated. Due to the good data situation in Europe, the tonsillotomy for children and adolescents with tonsillar hyperplasia and rare tonsillitis is always preferable to tonsillectomy [101], [212].

In recurrent tonsillitis, however, it comes down to the frequency, severity, and additional diseases (antibiotic allergies, immunosuppression, PFAPA syndrome). In these

cases, most guidelines adhere to the so-called *Paradise* criteria that refer to a study by JL Paradise from 1984. It could be shown in a collective of n=187 children between 3 and 15 years old that a tonsillectomy significantly lowers the frequency of severe recurrent sore throat if it previously occurred

- 7 episodes/year in one year or
- 5 episodes each/year in two consecutive years or
- 3 episodes each/year of tonsillitis in three consecutive years [153]

The diagnosis “purulent tonsillitis” must however be medically documented and confirmed by elevated temperature $>38.3^{\circ}\text{C}$, tonsillar exudate, enlarged lymph nodes in the jaw angle, and performed antibiotic treatment [153], [154]. The authors also point out that only a few (not all) throat infections in the next 2 years can be prevented by tonsillectomy on average, and that 47 of 187 patients withdrew from the planned three-year follow-up [153]. For less severe sore throat inflammation or rarer frequency throat inflammation, the risk of tonsillectomy does not outweigh the benefits [155]. While the tonsils make a certain contribution to immune competence until 12 years old, a negative long-term effect on the immune system, however, cannot be proven [116]. Nevertheless, in children under 8 years of age, the indication for complete removal must be strictly made, since the risk of serious or fatal bleeding is further increased [241].

In contrast, in the tonsillotomy there remains lymphatic active tissue. This continues to grow in about 15% of cases, but rarely causes problems such as renewed snoring or recurrent tonsillitis [208]. The fear that after tonsillotomy frequent tonsillitis or peritonsillar abscess will occur is unfounded [65], [194], [205]. All crypts remain open during the laser, ultrasound, shaver, high-and radiofrequency technique [194], [205].

Mononucleosis or lymphoma is no longer any indication for extracapsular tonsillectomy. In peritonsillar abscess or unilateral tonsillitis it must be carefully weighed whether to operate on the inflammation-free opposite side since here a clearly elevated risk of bleeding exists (Table 1).

Surgical techniques

Extracapsular tonsillectomy

The world's most commonly performed surgical technique in children and adults is the *cold dissection*. That is, the tonsils are dissected from the tonsil bed partly sharply and partly bluntly with a raspatorium and the scissors. The feeding vessels, especially at the upper and lower tonsil pole, are pinched off and then selectively ligated or coagulated with bipolar forceps. After removal of the tonsils, a dry swab is pressed for about 1 minute into the tonsil bed to stop the bleeding of small vessels. Some schools perform additional suturing of the lower pole (so-

Table 1: Summary of the different recommended therapies of the palatine tonsils

Tonsillar disease	Therapy
Acute tonsillitis with bacteria	Analgesia (ibuprofene, local bezocaine, steroids and betalactame antibiotics (i.e. after swab result)
Common cold	In most cases a virus! Analgesia and steroids
Recurrent acute tonsillitis with Downtime and 5-7 episodes per year	Complete extracapsular tonsillectomy
Tonsillar hyperplasia with ronchopathia	Partial tonsillectomy
Tonsillar abcess (quinsy)	Abcess drain via tonsillectomy puncture or aspiration. Before surgery: betalactame antibiotics + metronidazole, steroids and pain killer.
Mononucleosis	Analgesia, steroids, rest in bed, ultrasound of splen and liver, i.e. parenteral feeding.

called pole suturing, a controversial method [232]). This method of tonsillectomy has been known for decades and has been very commonly used, especially in the 70s and 80s with the discovery of the tonsils as a source of infection [125]. Optical magnification aids (microscope or magnifying glasses), as described by M. Andrea for the first time, make it possible to specifically depict the afferent smaller vessels and perform bipolar coagulation before dissection [10]. In our study, however, no difference in postoperative pain was demonstrated (publication in preparation). Whether it is possible by this “more targeted” surgical technique to really reduce the rate of late postoperative bleeding, however, remains uncertain, as all studies involve small numbers of cases [10], [128]. The use of a surgical microscope with monitor certainly makes sense as part of the training.

Due to the good long-term results and low morbidity and mortality, the *cold dissection*, formerly, as now, is still the most common method of tonsillectomy [67].

Tonsillotomy

In recent years, the partial removal of the tonsil, the so-called “tonsillotomy”, has been rediscovered [106]. In this, the complete tonsil is not removed, but only the portion bulging into the throat, which due to its oversize gives rise to functional disorders. Thus, it remains a lymphatic and immunologically active rudiment.

More than 2000 years ago, tonsillotomy was performed with the fingers and various tonsil surgeries were carried out [71]. Regularly until the 90s and nowadays in the Netherlands the Sluder tonsillotomy was performed with the cigar-cutter like tonsillotome developed by Ph. Physick (1828) [141] or a guillotine-like forceps under local anaesthesia or sedation in less than 10 seconds (<http://www.youtube.com/watch?v=WTEuyet9v9A>). The tonsil is well supplied with blood and has to be sufficiently cut and coagulated (not crushed) during surgery so that there is no postoperative bleeding, infection or pain. To this end, several surgical procedures have been developed in recent years:

- Dissection with the CO₂ laser [222]
- Dissection with hot knife [131]
- Dissection with monopolar high frequency current [51]
- Dissection with the ultrasound scalpel [86]
- Dissection with bipolar radiofrequency coblation [160]
- Dissection with bipolar scissors [104]
- Dissection with argon gas-assisted monopolar needle [99]
- Removal of the excess tissue with the microdebrider [137]

In principle, a tonsillectomy can also be performed with all of these methods. The advantage of the tonsillotomy (regardless of what method is used to reduce the tonsils) is the significantly lower pain [205] and the lower postoperative bleeding rate [193] compared with the tonsillectomy.

Intracapsular tonsillectomy

All methods of tonsillotomy may also be used for intracapsular (subtotal) tonsillectomy. The tonsil capsule remains in the fossa and covers the underlying muscle [243]. Slightly less postoperative pain and earlier food intake are the result [202]. In the intracapsular tonsillectomy it is sometimes very difficult to determine the exact proportion of residual tonsil that remains. In particular, after some tonsillitis with subsequent scarring, it is difficult even with magnifying glasses or a surgical microscope to seek out the exact layer in the tonsil capsule and only remove the active lymphatic tissue. According to the literature the microdebrider has been useful for this [30], [148], [173], [202], [203], [227]. In adults foetor from the mouth or bothersome detritus in the crypts may be an indication. However, there is not one appropriate indication in childhood since tonsillotomy is indicated for tonsil hyperplasia and tonsillectomy is indicated for tonsillitis.

Cryptolysis

The same applies to the cryptolysis. Here individual crypts should be selectively heated, either with the laser or a

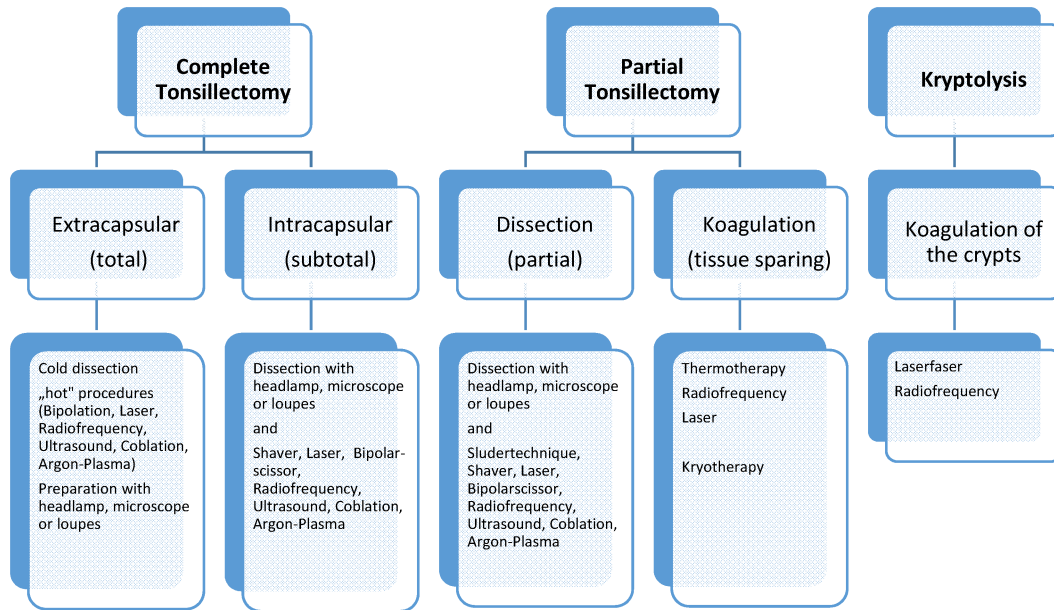


Figure 9: Summary of the surgical therapies on the tonsils actually available

high frequency current. The procedure is performed under local anaesthesia and on adults (<http://www.youtube.com/watch?v=5ypsygjSBow>). In a new study from the United States, with laser cryptolysis the number of cases of acute tonsillitis should also be reduced after the procedure [124].

Thermotherapy/cryotherapy of the tonsils

Hyperplastic tonsils with rhonchopathy are specified as an indication. The tonsils are interstitially heated (<http://www.youtube.com/watch?v=Sgr9WzgrOmY>) or cooled with a cryoprobe [134], [246]. In the course of 2 weeks, shrinkage of the fabric results with fully preserved tonsil capsule and surface. No tissue is removed and a large part of the lymphatic tissue remains supposedly functional. However, swelling of the tonsils, especially in the perioperative period, may occur, which with very large tonsils with already obstructive narrowing represents a contraindication. The risk of bleeding and the pain are minimal. The procedure can be performed under local anaesthesia, sedation or general anaesthesia.

In principle, interstitial thermotherapy is possible with all high frequency, radiofrequency or laser systems in the coagulation mode [162] (Figure 9).

Postoperative pain

Operations on the tonsils, on the highly sensitive innervated mucosa and underlying muscle are extremely painful, especially if the capsule is broken and the muscle is exposed. Severe pain and superinfection of the wound bed can lead to prolonged healing courses with a longer hospital stay. In particular, adolescent and adult patients still report pain, exhaustion and fatigue weeks after surgery.

Wound bed infections with inflammation of the lateral cords are blamed for this [139]. In the classical (extracapsular) tonsillectomy the wound remains open and heals in the next 2–3 weeks secondarily by granulation. Sealing the wound beds postoperatively (e.g. with fibrin glue [197] or sucralfate [186]) produces no advantage in postoperative bleeding or in pain management. The suturing of the palatal arch is controversial and is obviously dependent on the expertise of the surgeon [143], [199].

After classical tonsillectomy, for adolescents the pain in the first week after surgery, despite solid analgesic regimen, was around 5 on the numeric pain analogue scale (0–10), where in the morning and at meals particularly severe pain was reported [206].

With tonsillotomy, however, pain was reported as only around 2–3 on the numerical analogue scale, where here mostly children <12 years are affected. Less pain was also reported with the tonsillectomy than for teenagers and adults [129], [185]. In the intracapsular tonsillectomy there should allegedly be less pain than with the tonsillectomy [30]. However, it is unlikely that the intracapsular tonsillectomy reaches the low level of pain of the tonsillotomy.

Pain is inter-individually perceived very differently. In children and adults, the differences, regardless of the surgeon and the method, can be enormous [129], [206], [207]. Children of African descent suffer more postoperative pain than Europeans and react better to opiates for it [184]. This complicates both objective pain measurements (which do not exist), as well as a standard therapy. Pain therapy must therefore be individualized and adjusted, especially in children.

As a measuring method, numerical analogue scales have been provided for children with the Hicks version with laughing and weeping faces [223]. Questionnaires (e.g. Ramsay Sedation Scale [220]) for analgesic use, food intake, otalgia, kindergarten or school downtime are using

popular surrogate parameters. An interesting postoperative pain benchmarking project was constructed by W. Meissner from Jena with the QUIPS for children [163]. Here the analgesic regimes of different clinics can be standardized, validated and compared with one another by questionnaires sent postoperatively.

Since pain is perceived and processed multimodally, the treatment must be multimodal. First, postoperatively or perioperatively a local long-lasting pain reliever (e.g. Ropivacaine [151]) should be injected into the wound after the tonsillectomy in order to prevent the early pain pathway [11], [206], [207]. Then already perioperatively it should be cooled locally by cold compress [180] and later a lot of ice should be eaten (local cooling and calorie intake) [217]. Mouthwashes with gingicaine, benzocaine or tetracaine also provide pain relief, but also numb the taste buds and respiratory flow receptors, which is often perceived as very unpleasant.

The perioperative and postoperative administration of high-dose steroids (dexamethasone or prednisolone) is clearly recommended in all guidelines. This reduces postoperative nausea and analgesic consumption significantly [169], [209], [237].

A fixed analgesic regimen with ibuprofen or diclofenac makes sense in adolescents, but for children and infants rescue medication is often enough [13], [215]. An increased risk of bleeding due to non-steroidal anti-inflammatory drugs, (except for aspirin) should not be feared [135], [175]. One should therefore adhere to the WHO staging system [247] (<http://www.who.int/cancer/palliative/painladder/en/>). After tonsillectomy, it may well be that in the first days WHO stage III drugs (strong opioid, e.g. piritramide i.v.) or even a pain pump must be administered to ensure pain under 4 on the visual analogue scale and adequate food intake [85]. Pain and nausea (with and without vomiting) after tonsillectomy are often trivialized by both nurses as well as physicians and therefore it is more likely that few analgesics will be administered postoperatively [110], [204], [206].

Lastly, for children and their parents the psychological aspect of the possibly first surgery and postoperative pain are also taken into account. An open conversation with the child and the parents about the origin, duration, and treatment of pain eases fears and insecurities, and has a positive effect on postoperative healing [48], [109].

Postoperative bleeding

Early and late postoperative bleeding

Postoperative bleeding can occur until the wound is completely healed, despite careful intraoperative hemostasis and dissection. This is usually the case after 2–3 weeks.

Postoperative bleeding occurs either as so-called early bleeding within the first 24 hours, or in the form of late bleeding with a peak incidence between the 5th and 8th day after surgery. From the 3rd postoperative week

postoperative bleeding occurs only very rarely. Therefore, late postoperative bleeding represents a special problem because it often occurs only at home and therefore the time factor in getting professional help and the proper response of the children or their parents play a major role.

The most common cause of late bleeding is the physiological detachment of the fibrine layers from the open wound bed and usually results in harmless bleeding. This bleeding almost always ends spontaneously, or due to local icing (sucking ice cubes, applying an ice cravat) or by tranexamic acid intravenously or locally (rinsing) [33].

If this bleeding does not spontaneously subside because, for example, a larger vessel is opened, a specific coagulation is used – vessel ligation or suturing under anaesthesia is required (in around 1–5% of children undergoing tonsillectomies) [190]. For every 50,000 extracapsular tonsillectomies there is however one life-threatening bleeding [240]. Such massive bleeding is signalled in most cases by a minor “warning bleeding” [188], [241], so any bleeding must be taken seriously and the patient must be hospitalized.

Postoperative bleeding depending on the selected method of surgery

In principle, intraoperative bleeding and postoperative bleeding can occur in all interventions involving the tonsils. However, for the tonsillectomy the postoperative bleeding rate is, by a factor of 5–10, lower than that for the tonsillectomy [95]. In cryptolysis and thermotherapy of the tonsils postoperative bleeding is a rarity [124], [160]. Thus, the extracapsular tonsillectomy remains really problematic. Here the “cold dissection” with ligation or suturing shows the lowest postoperative bleeding rates. After laser, coblation, monopolar or bipolar techniques, there seems significantly more severe late postoperative bleeding [190], [192], [244].

Postoperative bleeding depending on the surgeon

Even if many surgeons do not believe it or don't want to hear it: the experience of the surgeon plays only a minor role in the severe postoperative bleeding [77], [190], [206]. Any surgeon can experience severe postoperative bleeding as soon as he or she has reached a certain number of tonsillectomies. The outcome of severe, transfusion-requiring postoperative bleeding is much more dependent on the emergency management and the frequency of tonsillectomies performed in each hospital [187], [189]. It was found in a Bavaria- and Saarland-wide survey that the main or inpatient departments that perform tonsillectomies more often have a lower percentage of postoperative bleeding requiring revision [248].

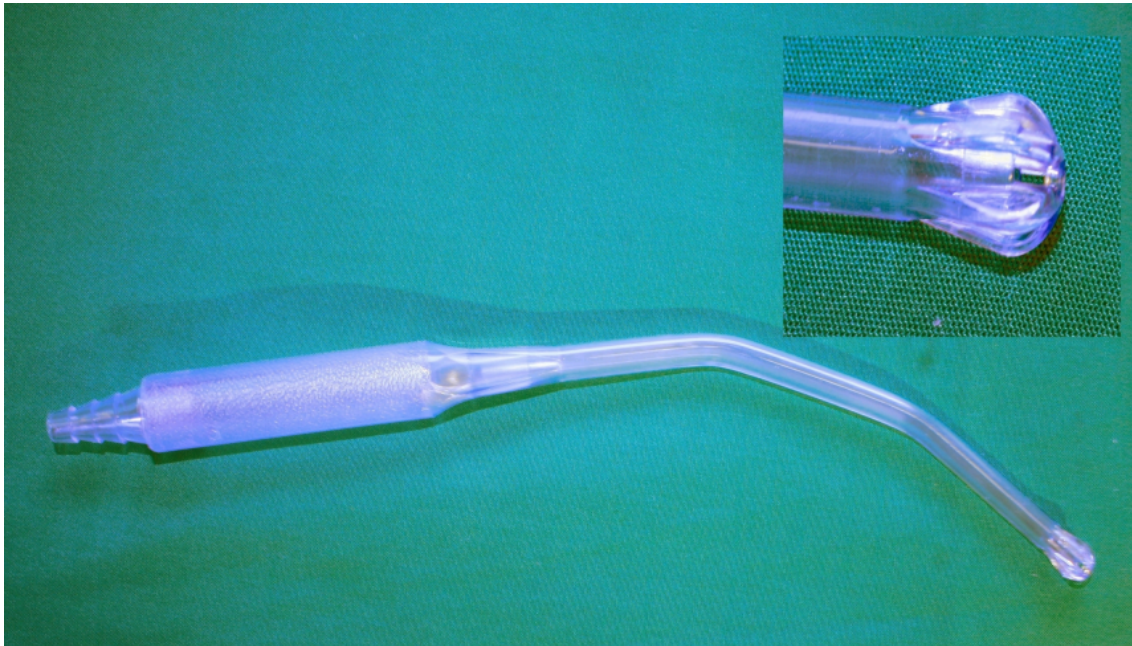


Figure 10: Rigid tonsil or thoracic suction device manufactured by Cardinal Health, IL, USA (Medi-Vac® Yankauer Suction Handle, REF KEX80)

Postoperative bleeding depending on the preoperative coagulation status

Patients with untreated coagulation disorders have an increased risk of postoperative bleeding. Especially in children who undergo surgery for the first time, an increased bleeding tendency may have thus far gone undetected. The most common coagulopathy in Europe is the Von-Willebrand's syndrome, an inherited quantitative or qualitative defect of von Willebrand factor, which leads to impaired platelet aggregation and faster degradation of coagulation factor VIII [23]. The problem with this clotting disorder is that it does not really stand out with an elevated PTT or INR [61]. Therefore, preoperative screening methods using INR and PTT are pointless. Sensitive (97.6%) [61] and simple is the standardized bleeding history of the child and the parents (17-point checklist) [96]. This is also recommended by the professional associations of Paediatrics, Anaesthesia and ENT [96]. A specially conducted survey, however, showed that in Bavaria only about a third of operative ENT doctors follow this recommendation [248]. INR and PTT are still frequently determined. A pathological history for a child should be clarified by a coagulation specialist. Despite appropriate preoperative and postoperative treatment, the risk of postoperative bleeding is usually higher than in healthy children [245]. Therefore, children with coagulation disorders should be hospitalized and operated on at a medical centre featuring transfusion medicine and hemostasis and with longer follow-up [214].

Management of postoperative bleeding

As soon as the preoperative stage, the patient or the parents should be advised that children, in particular,

after a classic tonsillectomy must be constantly monitored (especially at night) for a period of about 3 weeks so that in case of postoperative bleeding medical help can be immediately summoned. **A corresponding fact sheet should be provided after each tonsillectomy** (e.g. on http://www.hno.at/fileadmin/hno/pdfs/Merkblatt_Verhalten_bei_Nachblutung_nach_TE.pdf). Physical exertion and travel should be avoided, and medications that contain aspirin or warfarin should not be taken at this time because they increase the risk of bleeding.

Each postoperative bleeding, even "minor", which subsides spontaneously, must be taken seriously (warning bleeding). An inpatient admission is semi-essential because the likelihood of further, more severe bleeding after bleeding has taken place is increased by five times [23]. If the urgency permits, the patient should be taken by paramedics or, if necessary, a medivac helicopter to the nearest ENT main department or surgical department with ENT specialist care. Transportation by one's own private car should only be performed in exceptional cases and with short distances to the nearest ENT department. This is because there is a particular life-threatening danger either due to the risk of bleeding to death, because toddlers in particular have a small blood volume and can swallow a relatively lot of blood unnoticed, or by suffocation as a result of inhalation of blood into the lower respiratory passages. For the emergency physician, the intubation of massive postoperative bleeding after tonsillectomy is an extreme challenge, which can only be accomplished with a suitable rigid tonsil suction device (Figure 10).

In the hospital it must be decided whether the child must be moved immediately to the operating room, or can initially be treated conservatively with ice and hemostyptic drugs (e.g. oral and i.v. tranexamic acid [33]). In any case, a large-bore access should be created and blood re-

moved, so that the current Hb-level and clotting (Disseminated intravascular coagulation!) can be determined and blood cross matching can be performed for reserves. In the case of super infected fibrine layers (inspection and smell) broad-spectrum antibiotics (e.g. cefuroxime) should be [31] administered. Prophylactic antibiotic administration, however, makes no sense [2], [57].

If the bleeding does not stop or becomes more severe (blood dripping from the mouth), surgery must be performed under general anaesthesia. During introduction and intubation, the ENT doctor should be present and prepared to perform cricothyrotomy. Aspirated blood or incorrect intubations are the most common clinical complications of postoperative bleeding [242]. Intraoperatively, the specialist must decide whether a targeted bipolar coagulation and swab pressure are sufficient or whether suturing or ligations are necessary. If that is not enough, either the lingual artery, ascending pharyngeal artery, facial artery or even the external carotid artery must be ligated from the outside or through an interventional radiology the feeding vessels must be sealed.

After each surgical intervention because of postoperative bleeding a child should be hospitalized and monitored for several days. After each bleeding (even minor) a child should be monitored for at least 24 hours. With bleeding children may swallow the blood in any case because it triggers first, nausea and vomiting, and secondly, it cannot be guessed how high the actual blood loss was.

Inpatient or outpatient treatment and billing

After a classical tonsillectomy children should, **for at least 3–4 days and possibly longer, be postoperatively monitored as an inpatient.** Inpatient treatment is medically useful:

- because of the risk of rare emergency bleeding;
- for treatment for more severe postoperative pain;
- for the management of postoperative food intake and sufficient hydration.

The decision on the duration of the hospital stay must ultimately be made in each individual case by the attending otolaryngologist in consultation with the patient and, if necessary, the parents.

An extension of the inpatient stay is for example useful when an increased risk of bleeding or other health risks exist. This also applies to patients with a very long journey in case of postoperative bleeding, or if appropriate home nursing or care is not guaranteed. A clear time specification of the duration of the hospitalization on the part of the AWMF or ENT society also does not exist because of this. Inpatient treatment with tonsillectomy as such is however not controversial.

With tonsillotomy, cryptolysis or thermotherapy both the pain and the risk of postoperative bleeding are much lower, so this could in principle be performed on an outpatient basis. However, postoperative care by the parents

or relatives must be absolutely guaranteed for at least 10 days, because while the occurrence of late bleeding may be rare, early postoperative bleeding may well occur [236].

Billing

The extracapsular tonsillectomy (5-281.0) in children is performed on an inpatient basis in Germany and billed according to DRG D30B. According to DRG D30B, the tonsillotomy (5-281.5) can be billed either as an inpatient procedure with the same average length of stay of 5 days, or as an outpatient procedure by special agreements with individual insurance providers pursuant to § 73c SGB V. Here after some requirements are met (QM system, only certain devices, special (photo)documentation, training certificate) the tonsillotomy (with or without adenotomy and paracentesis) is performed on an outpatient basis and a flat rate is paid. Billing pursuant to § 115b SGB V or EBM2010 is not possible on an outpatient basis and therefore must be legally settled (without special contract) by private practice under the doctor's fee schedule (GOÄ) [235].

It is known that the GOÄ compensation system involves economic incentives, but they may not affect the indication. The indication for tonsillotomy (also in consideration for tonsillectomy) must always be strictly posed, as tempting as it may be from a business side as well. A good reasonably and sufficiently documented indication is not only the highest medical duty to the patient and his family, but it also protects against the influence of third parties [235].

Patient information and clarification

A patient brochure with behavioural guidelines after tonsillectomy and especially an emergency plan in case of postoperative bleeding should be given to parents before the inpatient stay. Here the closest hospital featuring an ENT department and in addition to the general emergency number (112) contact data for the attending physicians are shown (example of the Austrian Society for ENT on http://www.hno.at/fileadmin/hno/pdfs/Merkblatt_Verhalten_bei_Nachblutung_nach_TE.pdf).

The clarification of the surgery must be performed well in advance (at least 24 hours before the surgery) and well documented. A conversation with a doctor must be carried out in each case and be documented in the patient record, for example with pre-printed sheets.

For children, the guardian or custodian must be included in the clarification and must sign the clarification. In cases of an unclear family situation it is advisable to have both custodial parents sign it.

Under the new patients' rights law (Civil Code § 630e (2) paragraph 4) a copy of the clarification sheet must be given to the signatories, with separate custody and both parties. If one of the custodial parents refuses to consent

to the operation, the treatment can be carried out only after a court decision. The clarification of custody is a medical matter and belongs to the clarification.

In conclusion

It should be mentioned that at present nationally and internationally, the indication for the (partial) removal of the palatine tonsils is in flux and the ENT surgeons must be aware of their great responsibility when determining indications, especially in children. This is particularly difficult to correctly estimate, because actual major evidence-based studies on indications and effects hardly exist. Since tonsil surgery, however, is still one of the most common surgical procedures in ENT, it is urgently necessary to qualify more and more evidence-based studies to back up the positive effects of well-indicated tonsil operations for the future.

Notes

Competing interests

The author declares that he has no competing interests.

References

- Alavoine J, Graber A. L'amygdalectomie extracapsulaire sous anesthésie général [Extracapsular tonsillectomy under general anesthesia]. *Rev Laryngol Otol Rhinol (Bord)*. 1968 Sep-Oct;89(9):568-79.
- Al-Layla A, Mahafza TM. Antibiotics do not reduce post-tonsillectomy morbidity in children. *Eur Arch Otorhinolaryngol*. 2013 Jan;270(1):367-70. DOI: 10.1007/s00405-012-2119-z
- Al-Mazrou KA, Al-Khattaf AS. Adherent biofilms in adenotonsillar diseases in children. *Arch Otolaryngol Head Neck Surg*. 2008 Jan;134(1):20-3. DOI: 10.1001/archoto.2007.18
- Almqvist U. Cryosurgical treatment of tonsillar hypertrophy in children. *J Laryngol Otol*. 1986 Mar;100(3):311-4. DOI: 10.1017/S0022215100099205
- Alpert JJ, Peterson OL, Colton T. Tonsillectomy and adenoidectomy. *Lancet*. 1968 Jun;1(7555):1319. DOI: 10.1016/S0140-6736(68)92344-1
- Altamimi S, Khalil A, Khalaiwi KA, Milner R, Pusic MV, Al Othman MA. Short versus standard duration antibiotic therapy for acute streptococcal pharyngitis in children. *Cochrane Database Syst Rev*. 2009;(1):CD004872. DOI: 10.1002/14651858.CD004872.pub2
- Altamimi S, Khalil A, Khalaiwi KA, Milner RA, Pusic MV, Al Othman MA. Short-term late-generation antibiotics versus longer term penicillin for acute streptococcal pharyngitis in children. *Cochrane Database Syst Rev*. 2012;8:CD004872. DOI: 10.1002/14651858.CD004872.pub3
- Anand A, Vilela RJ, Guarisco JL. Intracapsular versus standard tonsillectomy: review of literature. *J La State Med Soc*. 2005 Sep-Oct;157(5):259-61.
- Andrasević AT, Baudoin T, Vukelić D, Matanović SM, Bejuk D, Puzevski D, Abram M, Tesović G, Grgurev Z, Tomac G, Pristas I; Interdisciplinary Section for Antibiotic Resistance Control (ISKRA). Smjernice iskra za grlobolju: dijagnostički i terapijski pristup–Hrvatske nacionalne smjernice [ISKRA guidelines on sore throat: diagnostic and therapeutic approach–Croatian national guidelines]. *Lijec Vjesn*. 2009 Jul-Aug;131(7-8):181-91.
- Andrea M. Microsurgical bipolar cautery tonsillectomy. *Laryngoscope*. 1993 Oct;103(10):1177-8. DOI: 10.1288/00005537-199310000-00018
- Arikan OK, Ozcan S, Kazkayasi M, Akpınar S, Koc C. Preincisional infiltration of tonsils with ropivacaine in post-tonsillectomy pain relief: double-blind, randomized, placebo-controlled intraindividual study. *J Otolaryngol*. 2006 Jun;35(3):167-72.
- Bárzaga Arencibia Z, Choonara I. Balancing the risks and benefits of the use of over-the-counter pain medications in children. *Drug Saf*. 2012 Dec;35(12):1119-25. DOI: 10.2165/11633620-000000000-00000
- Baugh RF, Archer SM, Mitchell RB, Rosenfeld RM, Amin R, Burns JJ, Darrow DH, Giordano T, Litman RS, Li KK, Mannix ME, Schwartz RH, Setzen G, Wald ER, Wall E, Sandberg G, Patel MM; American Academy of Otolaryngology-Head and Neck Surgery Foundation. Clinical practice guideline: tonsillectomy in children. *Otolaryngol Head Neck Surg*. 2011 Jan;144(1 Suppl):S1-30. DOI: 10.1177/0194599810389949
- Bellussi LM, Marchisio P, Matera E, Passàli FM. Clinical guideline on adenotonsillectomy: the Italian experience. *Adv Otorhinolaryngol*. 2011;72:142-5. DOI: 10.1159/000324772
- Bereznoy VV, Riley DS, Wassmer G, Heger M. Efficacy of extract of *Pelargonium sidoides* in children with acute non-group A beta-hemolytic streptococcus tonsillopharyngitis: a randomized, double-blind, placebo-controlled trial. *Altern Ther Health Med*. 2003 Sep-Oct;9(5):68-79.
- Berger C, Hug M, Gysin C, Molinari L, Frei M, Bossart W, Nadal D. Distribution patterns of beta- and gamma-herpesviruses within Waldeyer's ring organs. *J Med Virol*. 2007 Aug;79(8):1147-52. DOI: 10.1002/jmv.20899
- Berger T. Verträglichkeit und Wirksamkeit eines pflanzlichen Kombinationspräparats. Anwendungsbeobachtung bei Kindern und Jugendlichen mit rezidivierenden Infektionen der oberen Atemwege [Tolerability and efficacy of a herbal combination preparation in children and adolescents with recurrent infections of the upper respiratory tract]. *MMW Fortschr Med*. 2008 Jun;150 Suppl 2:85-90.
- Berghaus A. Chronische Entzündungen der oberen Atemwege. Operation statt Antibiotikum [Chronic inflammation of the upper airways. Operation instead of antibiotic]. *MMW Fortschr Med*. 2005 Sep;147(39):27.
- Berghaus A, Pirsig W. Mundhöhle und Pharynx. In: Berghaus A, Rettinger G, Böhme G, eds. Hals-Nasen-Ohren-Heilkunde. 1st ed. Stuttgart: Hippokrates Verlag; 1996. 386-453.
- Berkowitz RG, Mahadevan M. Unilateral tonsillar enlargement and tonsillar lymphoma in children. *Ann Otol Rhinol Laryngol*. 1999 Sep;108(9):876-9.
- Bewarder F, Pirsig W. Spätergebnisse nach submuköser Septumresektion [Long-term results of submucosal septal resection (author's transl)]. *Laryngol Rhinol Otol (Stuttg)*. 1978 Oct;57(10):922-30.
- Bhattacharyya N, Lin HW. Changes and consistencies in the epidemiology of pediatric adenotonsillar surgery, 1996-2006. *Otolaryngol Head Neck Surg*. 2010 Nov;143(5):680-4. DOI: 10.1016/j.otohns.2010.06.918
- Bidlingmaier C, Olivieri M, Stelter K, Eberl W, von Kries R, Kurnik K. Postoperative bleeding in paediatric ENT surgery. First results of the German ESPED trial. *Hamostaseologie*. 2010 Nov;30 Suppl 1:S108-11.

24. Borschmann ME, Berkowitz RG. One-off streptococcal serologic testing in young children with recurrent tonsillitis. *Ann Otol Rhinol Laryngol*. 2006 May;115(5):357-60.
25. Brandtzaeg P. Immune functions of nasopharyngeal lymphoid tissue. *Adv Otorhinolaryngol*. 2011;72:20-4. DOI: 10.1159/000324588
26. Brandtzaeg P. The B-cell development in tonsillar lymphoid follicles. *Acta Otolaryngol Suppl*. 1996;523:55-9.
27. Braun T, Dreher A, Dirr F, Reichel O, Patscheider M. Kindliches OSAS und Seromukotympanon [Pediatric OSAS and otitis media with effusion]. *HNO*. 2012 Mar;60(3):216-9. DOI: 10.1007/s00106-011-2410-0
28. Brook I, Foote PA Jr. Comparison of the microbiology of recurrent tonsillitis between children and adults. *Laryngoscope*. 1986 Dec;96(12):1385-8. DOI: 10.1288/00005537-198612000-00013
29. Burton MJ, Towler B, Glasziou P. Tonsillectomy versus non-surgical treatment for chronic / recurrent acute tonsillitis. *Cochrane Database Syst Rev*. 2000;(2):CD001802. DOI: 10.1002/14651858.CD001802
30. Cantarella G, Viglione S, Forti S, Minetti A, Pignataro L. Comparing postoperative quality of life in children after microdebrider intracapsular tonsillectomy and tonsillectomy. *Auris Nasus Larynx*. 2012 Aug;39(4):407-10. DOI: 10.1016/j.anl.2011.10.012
31. Casey JR, Pichichero ME. Meta-analysis of cephalosporin versus penicillin treatment of group A streptococcal tonsillopharyngitis in children. *Pediatrics*. 2004 Apr;113(4):866-82. DOI: 10.1542/peds.113.4.866
32. Champeau D. Intracapsular tonsillectomy. *Ann Otolaryngol*. 1961 Dec;78:866-9.
33. Chan CC, Chan YY, Tanweer F. Systematic review and meta-analysis of the use of tranexamic acid in tonsillectomy. *Eur Arch Otorhinolaryngol*. 2013 Feb;270(2):735-48. DOI: 10.1007/s00405-012-2184-3
34. Chan SC, Dawes PJ. The management of severe infectious mononucleosis tonsillitis and upper airway obstruction. *J Laryngol Otol*. 2001 Dec;115(12):973-7. DOI: 10.1258/0022215011909792
35. Chang CY, Thrasher R. Coblation cryptolysis to treat tonsil stones: a retrospective case series. *Ear Nose Throat J*. 2012 Jun;91(6):238-54.
36. Chang KW. Intracapsular versus subcapsular coblation tonsillectomy. *Otolaryngol Head Neck Surg*. 2008 Feb;138(2):153-157. DOI: 10.1016/j.otohns.2007.11.006
37. Chatziavramidis A, Constantinidis J, Gennadiou D, Derwis D, Sidiras T. Volumenreduktion bei Tonsillenhyperplasie im Kindesalter durch ein operatives Ultraschallsystem [Volume reduction of tonsil hyperplasia in childhood with a surgical ultrasound device]. *Laryngorhinootologie*. 2007 Mar;86(3):177-83. DOI: 10.1055/s-2006-944754
38. Chiappini E, Principi N, Mansi N, Serra A, De Masi S, Camaioni A, Esposito S, Felisati G, Galli L, Landi M, Speciale AM, Bonsignori F, Marchisio P, de Martino M; Italian Panel on the Management of Pharyngitis in Children. Management of acute pharyngitis in children: summary of the Italian National Institute of Health guidelines. *Clin Ther*. 2012 Jun;34(6):1442-1458.e2. DOI: 10.1016/j.clinthera.2012.04.028
39. Chiappini E, Regoli M, Bonsignori F, Sollai S, Parretti A, Galli L, de Martino M. Analysis of different recommendations from international guidelines for the management of acute pharyngitis in adults and children. *Clin Ther*. 2011 Jan;33(1):48-58. DOI: 10.1016/j.clinthera.2011.02.001
40. Chole RA, Faddis BT. Anatomical evidence of microbial biofilms in tonsillar tissues: a possible mechanism to explain chronicity. *Arch Otolaryngol Head Neck Surg*. 2003 Jun;129(6):634-6. DOI: 10.1001/archotol.129.6.634
41. Cingi C, Songu M, Ural A, Erdogmus N, Yildirim M, Cakli H, Bal C. Effect of chlorhexidine gluconate and benzydamine hydrochloride mouth spray on clinical signs and quality of life of patients with streptococcal tonsillopharyngitis: multicentre, prospective, randomised, double-blinded, placebo-controlled study. *J Laryngol Otol*. 2011 Jun;125(6):620-5. DOI: 10.1017/S0022215111000065
42. Cingi C, Songu M, Ural A, Yildirim M, Erdogmus N, Bal C. Effects of chlorhexidine/benzzydamine mouth spray on pain and quality of life in acute viral pharyngitis: a prospective, randomized, double-blind, placebo-controlled, multicenter study. *Ear Nose Throat J*. 2010 Nov;89(11):546-9.
43. Ciuman RR. Phytotherapeutic and naturopathic adjuvant therapies in otorhinolaryngology. *Eur Arch Otorhinolaryngol*. 2012 Feb;269(2):389-97. DOI: 10.1007/s00405-011-1755-z
44. Cohen JI, Mocarski ES, Raab-Traub N, Corey L, Nabel GJ. The need and challenges for development of an Epstein-Barr virus vaccine. *Vaccine*. 2013 Apr;31 Suppl 2:B194-6. DOI: 10.1016/j.vaccine.2012.09.041
45. Cohen MS, Getz AE, Isaacson G, Gaughan J, Szeremeta W. Intracapsular vs. extracapsular tonsillectomy: a comparison of pain. *Laryngoscope*. 2007 Oct;117(10):1855-8. DOI: 10.1097/MLG.0b013e318123ee40
46. Cohen R, Reinert P, De La Rocque F, Levy C, Boucherat M, Robert M, Navel M, Brahimi N, Deforche D, Palestro B, Bingen E. Comparison of two dosages of azithromycin for three days versus penicillin V for ten days in acute group A streptococcal tonsillopharyngitis. *Pediatr Infect Dis J*. 2002 Apr;21(4):297-303. DOI: 10.1097/00006454-200204000-00008
47. Coticchia JM, Yun RD, Nelson L, Koempel J. Temperature-controlled radiofrequency treatment of tonsillar hypertrophy for reduction of upper airway obstruction in pediatric patients. *Arch Otolaryngol Head Neck Surg*. 2006 Apr;132(4):425-30. DOI: 10.1001/archotol.132.4.425
48. Crandall M, Lammers C, Senders C, Braun JV, Savedra M. Children's pre-operative tonsillectomy pain education: clinical outcomes. *Int J Pediatr Otorhinolaryngol*. 2008 Oct;72(10):1523-33. DOI: 10.1016/j.ijporl.2008.07.004
49. Dal Rio AC, Passos CA, Nicola JH, Nicola EM. CO2 laser cryptolysis by coagulation for the treatment of halitosis. *Photomed Laser Surg*. 2006 Oct;24(5):630-6. DOI: 10.1089/pho.2006.24.630
50. Dalton RE, Abedi E, Sismanis A. Bilateral peritonsillar abscesses and quinsy tonsillectomy. *J Natl Med Assoc*. 1985 Oct;77(10):807-12.
51. Davies J, Coatesworth AP. Double-blind randomized controlled study of coblation tonsillectomy versus coblation tonsillectomy on post-operative pain. *Clin Otolaryngol*. 2005 Dec;30(6):572; author reply 572-3. DOI: 10.1111/j.1749-4486.2005.01117.x
52. Del Mar CB, Glasziou PP, Spinks AB. Antibiotics for sore throat. *Cochrane Database Syst Rev*. 2000;(2):CD000023. DOI: 10.1002/14651858.CD000023
53. Del Mar CB, Glasziou PP, Spinks AB. Antibiotics for sore throat. *Cochrane Database Syst Rev*. 2004;(2):CD000023. DOI: 10.1002/14651858.CD000023.pub2
54. Del Mar CB, Glasziou PP, Spinks AB. Antibiotics for sore throat. *Cochrane Database Syst Rev*. 2006;(4):CD000023. DOI: 10.1002/14651858.CD000023.pub3
55. Demir UL, Cetinkaya B, Karaca S, Sigirli D. The impacts of adenotonsillar hypertrophy on periodontal health in children: a prospective controlled pilot study. *Am J Otolaryngol*. 2013 Sep-Oct;34(5):501-4. DOI: 10.1016/j.amjoto.2013.04.013

56. Dhiwakar M, Clement WA, Supriya M, McKerrow W. Antibiotics to reduce post-tonsillectomy morbidity. *Cochrane Database Syst Rev.* 2012;12:CD005607. DOI: 10.1002/14651858.CD005607.pub4
57. Dhiwakar M, Clement WA, Supriya M, McKerrow WS. Antibiotics to reduce post-tonsillectomy morbidity. *Cochrane Database Syst Rev.* 2008;(2):CD005607. DOI: 10.1002/14651858.CD005607.pub2
58. Drago L, De Vecchi E, Torretta S, Mattina R, Marchisio P, Pignataro L. Biofilm formation by bacteria isolated from upper respiratory tract before and after adenotonsillectomy. *APMIS.* 2012 May;120(5):410-6. DOI: 10.1111/j.1600-0463.2011.02846.x
59. Drago L, Esposito S, De Vecchi E, Marchisio P, Blasi F, Baggi E, Capaccio P, Pignataro L. Detection of respiratory viruses and atypical bacteria in children's tonsils and adenoids. *J Clin Microbiol.* 2008 Jan;46(1):369-70. DOI: 10.1128/JCM.01819-07
60. Drucker M, Drucker I, Neter E, Bernstein J, Ogra PL. Cell mediated immune responses to bacterial antigens on human mucosal surfaces. *Adv Exp Med Biol.* 1978;107:479-88.
61. Eberl W, Wendt I, Schroeder HG. Präoperatives Screening auf Gerinnungsstörungen vor Adenotomie und Tonsillektomie [Preoperative coagulation screening prior to adenoidectomy and tonsillectomy]. *Klin Padiatr.* 2005 Jan-Feb;217(1):20-4. DOI: 10.1055/s-2004-818789
62. Eisfeld W, Deitmer T. Von der Mandelkappung über die Tonsillektomie zur Tonsillotomie [From tonsil capping to tonsillectomy to tonsillotomy]. *Laryngorhinootologie.* 2010 Mar;89(3):137-44. DOI: 10.1055/s-0029-1242796
63. el Barbary A el-S, Mohieddin O, Fouad HA, Khalifa MC. The tonsils and rheumatic fever. *Ann Otol Rhinol Laryngol.* 1969 Jun;78(3):648-56.
64. Erickson BK, Larson DR, St Sauver JL, Meverden RA, Orvidas LJ. Changes in incidence and indications of tonsillectomy and adenotonsillectomy, 1970-2005. *Otolaryngol Head Neck Surg.* 2009 Jun;140(6):894-901. DOI: 10.1016/j.otohns.2009.01.044
65. Ericsson E, Graf J, Hultcrantz E. Pediatric tonsillotomy with radiofrequency technique: long-term follow-up. *Laryngoscope.* 2006 Oct;116(10):1851-7. DOI: 10.1097/01.mig.0000234941.95636.e6
66. Ericsson E, Lundeborg I, Hultcrantz E. Child behavior and quality of life before and after tonsillotomy versus tonsillectomy. *Int J Pediatr Otorhinolaryngol.* 2009 Sep;73(9):1254-62. DOI: 10.1016/j.ijporl.2009.05.015
67. Ewah B. An evaluation of pain, postoperative nausea and vomiting following the introduction of guidelines for tonsillectomy. *Paediatr Anaesth.* 2006 Oct;16(10):1100-1; author reply 1101. DOI: 10.1111/j.1460-9592.2006.01973.x
68. Falcao P. Amigdalectomia palatina total intra-capsular; sistematização de técnica [Total intracapsular palatine tonsillectomy; systematization of technic]. *Rev Bras Otorrinolaringol.* 1954 Jul-Oct;22(4-5):309-32.
69. Feinstein AR, Levitt M. The role of tonsils in predisposing to streptococcal infections and recurrences of rheumatic fever. *N Engl J Med.* 1970 Feb;282(6):285-91. DOI: 10.1056/NEJM197002052820601
70. Feinstein AR, Levitt M. Tonsils and rheumatic fever. *N Engl J Med.* 1970 Apr;282(14):814. DOI: 10.1056/NEJM197004022821423
71. Feldmann H. 2000 Jahre Geschichte der Tonsillektomie. Bilder aus der Geschichte der Hals-Nasen-Ohren-Heilkunde, dargestellt an Instrumenten aus der Sammlung im Deutschen Medizinhistorischen Museum in Ingolstadt [2000 year history of tonsillectomy. Images from the history of otorhinolaryngology, highlighted by instruments from the collection of the German Medical History Museum in Ingolstadt]. *Laryngorhinootologie.* 1997 Dec;76(12):751-60. DOI: 10.1055/s-2007-997520
72. Finkelstein Y, Talmi YP, Ophir D, Berger G. Laser cryptolysis for the treatment of halitosis. *Otolaryngol Head Neck Surg.* 2004 Oct;131(4):372-7. DOI: 10.1016/j.otohns.2004.02.044
73. Fischer Y, Gronau S. Identifikation und Evaluation der kindlichen Schlafapnoe vor Adenotonsillektomie anhand evaluierter Fragebögen [Identification and evaluation of obstructive sleep apnea in children before adenotonsillectomy using evaluative surveys]. *Laryngorhinootologie.* 2005 Feb;84(2):121-35; quiz 136-40. DOI: 10.1055/s-2005-861005
74. Forrest JB, Heitlinger EL, Revell S. Ketorolac for postoperative pain management in children. *Drug Saf.* 1997 May;16(5):309-29. DOI: 10.2165/00002018-199716050-00003
75. Fried MP, Forrest JL. Peritonsillitis. Evaluation of current therapy. *Arch Otolaryngol.* 1981 May;107(5):283-6. DOI: 10.1001/archotol.1981.00790410021004
76. Fujikawa S, Hanawa Y, Ito H, Ohkuni M, Todome Y, Ohkuni H. Streptococcal antibody: as an indicator of tonsillectomy. *Acta Otolaryngol Suppl.* 1988;454:286-91. DOI: 10.3109/00016488809125042
77. Gallagher TQ, Wilcox L, McGuire E, Derkay CS. Analyzing factors associated with major complications after adenotonsillectomy in 4776 patients: comparing three tonsillectomy techniques. *Otolaryngol Head Neck Surg.* 2010 Jun;142(6):886-92. DOI: 10.1016/j.otohns.2010.02.019
78. Gebhardt B, Herrmann K, Roessner A, Vorwerk U. Differenzialdiagnostik der nekrotisierenden Tonsillitis [Differential diagnosis of unilateral necrotic tonsillitis]. *Laryngorhinootologie.* 2010 May;89(5):266-9. DOI: 10.1055/s-0029-1243192
79. Georgalas C, Kanagalingam J, Zainal A, Ahmed H, Singh A, Patel KS. The association between periodontal disease and peritonsillar infection: a prospective study. *Otolaryngol Head Neck Surg.* 2002 Jan;126(1):91-4. DOI: 10.1067/mhn.2002.121318
80. Georgalas CC, Tolley NS, Narula A. Recurrent throat infections (tonsillitis). *Clin Evid (Online).* 2007 Jun 1;2007. pii: 0503.
81. Georgalas CC, Tolley NS, Narula A. Tonsillitis. *Clin Evid (Online).* 2009 Oct 26;2009. pii: 0503.
82. Gerber MA, Randolph MF, Chanatry J, Wright LL, De Meo K, Kaplan EL. Five vs ten days of penicillin V therapy for streptococcal pharyngitis. *Am J Dis Child.* 1987 Feb;141(2):224-7.
83. Goldberg S, Shatz A, Picard E, Wexler I, Schwartz S, Swed E, Zilber L, Kerem E. Endoscopic findings in children with obstructive sleep apnea: effects of age and hypotonia. *Pediatr Pulmonol.* 2005 Sep;40(3):205-10. DOI: 10.1002/ppul.20230
84. Gronau S, Fischer Y. Die Tonsillotomie [Tonsillotomy]. *Laryngorhinootologie.* 2005 Sep;84(9):685-90; quiz 691-4. DOI: 10.1055/s-2005-861043
85. Hadden SM, Burke CN, Skotcher S, Voepel-Lewis T. Early postoperative outcomes in children after adenotonsillectomy. *J Perianesth Nurs.* 2011 Apr;26(2):89-95. DOI: 10.1016/j.jopan.2011.01.011
86. Haegner U, Handrock M, Schade H. Die "Ultraschalltonsillektomie" im Vergleich zur konventionellen Tonsillektomie ["Ultrasound tonsillectomy" in comparison with conventional tonsillectomy]. *HNO.* 2002 Sep;50(9):836-43. DOI: 10.1007/s00106-001-0607-3

87. Hay AD, Costelloe C, Redmond NM, Montgomery AA, Fletcher M, Hollinghurst S, Peters TJ. Paracetamol plus ibuprofen for the treatment of fever in children (PITCH): randomised controlled trial. *BMJ*. 2008;337:a1302.
88. Hay AD, Redmond NM, Costelloe C, Montgomery AA, Fletcher M, Hollinghurst S, Peters TJ. Paracetamol and ibuprofen for the treatment of fever in children: the PITCH randomised controlled trial. *Health Technol Assess*. 2009 May;13(27):iii-iv, ix-x, 1-163. DOI: 10.3310/hta13270
89. Hayward G, Thompson M, Heneghan C, Perera R, Del Mar C, Glasziou P. Corticosteroids for pain relief in sore throat: systematic review and meta-analysis. *BMJ*. 2009;339:b2976. DOI: 10.1136/bmj.b2976
90. Hayward G, Thompson MJ, Perera R, Del Mar CB, Glasziou PP, Heneghan CJ. Corticosteroids for the common cold. *Cochrane Database Syst Rev*. 2012;8:CD008116. DOI: 10.1002/14651858.CD008116.pub2
91. Hayward G, Thompson MJ, Perera R, Glasziou PP, Del Mar CB, Heneghan CJ. Corticosteroids as standalone or add-on treatment for sore throat. *Cochrane Database Syst Rev*. 2012;10:CD008268. DOI: 10.1002/14651858.CD008268.pub2
92. Helling K, Abrams J, Bertram WK, Hohner S, Scherer H. Die Lasertonsillotomie bei der Tonsillenhyperplasie des Kleinkindes [Laser tonsillectomy in tonsillar hyperplasia of early childhood]. *HNO*. 2002 May;50(5):470-8. DOI: 10.1007/s00106-001-0580-x
93. Herzon FS, Harris P. Mosher Award thesis. Peritonsillar abscess: incidence, current management practices, and a proposal for treatment guidelines. *Laryngoscope*. 1995 Aug;105(8 Pt 3 Suppl 74):1-17.
94. Herzon FS, Martin AD. Medical and surgical treatment of peritonsillar, retropharyngeal, and parapharyngeal abscesses. *Curr Infect Dis Rep*. 2006 May;8(3):196-202. DOI: 10.1007/s11908-006-0059-8
95. Hessén Söderman AC, Ericsson E, Hemlin C, Hultcrantz E, Månsson I, Roos K, Stalfors J. Reduced risk of primary postoperative hemorrhage after tonsil surgery in Sweden: results from the National Tonsil Surgery Register in Sweden covering more than 10 years and 54,696 operations. *Laryngoscope*. 2011 Nov;121(11):2322-6. DOI: 10.1002/lary.22179
96. Hörmann K. Gemeinsame Stellungnahme zur Notwendigkeit präoperativer Gerinnungsdiagnostik vor Tonsillektomie und Adenotomie bei Kindern [Joint statement on the need for preoperative coagulation tests before adenotomy and tonsillectomy in children]. *Laryngorhinootologie*. 2006 Aug;85(8):580-1. DOI: 10.1055/s-2006-944590
97. Howie JG, Foggo BA. Antibiotics, sore throats and rheumatic fever. *J R Coll Gen Pract*. 1985 May;35(274):223-4.
98. Huang Y, Wu T, Zeng L, Li S. Chinese medicinal herbs for sore throat. *Cochrane Database Syst Rev*. 2012;3:CD004877. DOI: 10.1002/14651858.CD004877.pub3
99. Huber K, Sadick H, Maurer JT, Hörmann K, Hammerschmitt N. Tonsillotomie mit der argonunterstützten, monopolaren Nadel-erste klinische Erfahrungen [Tonsillectomy with the argon-supported monopolar needle—first clinical results]. *Laryngorhinootologie*. 2005 Sep;84(9):671-5. DOI: 10.1055/s-2004-826234
100. Hug M, Dorner M, Fröhlich FZ, Gysin C, Neuhaus D, Nadal D, Berger C. Pediatric epstein-barr virus carriers with or without tonsillar enlargement may substantially contribute to spreading of the virus. *J Infect Dis*. 2010 Oct;202(8):1192-9. DOI: 10.1086/656335
101. Hultcrantz E, Ericsson E, Hemlin C, Hessén-Söderman AC, Roos K, Sunnergren O, Stalfors J. Paradigm shift in Sweden from tonsillectomy to tonsillotomies for children with upper airway obstructive symptoms due to tonsillar hypertrophy. *Eur Arch Otorhinolaryngol*. 2013 Sep;270(9):2531-6. DOI: 10.1007/s00405-013-2374-7
102. Hultcrantz E, Linder A, Markström A. Long-term effects of intracapsular partial tonsillectomy (tonsillotomies) compared with full tonsillectomy. *Int J Pediatr Otorhinolaryngol*. 2005 Apr;69(4):463-9. DOI: 10.1016/j.ijporl.2004.11.010
103. Hultcrantz E, Linder A, Markström A. Tonsillectomy or tonsillotomies? A randomized study comparing postoperative pain and long-term effects. *Int J Pediatr Otorhinolaryngol*. 1999 Dec;51(3):171-6. DOI: 10.1016/S0165-5876(99)00274-8
104. Isaacson G. Pediatric intracapsular tonsillectomy with bipolar electrosurgical scissors. *Ear Nose Throat J*. 2004 Oct;83(10):702, 704-6.
105. Isaacson G, Parikh T. Developmental anatomy of the tonsil and its implications for intracapsular tonsillectomy. *Int J Pediatr Otorhinolaryngol*. 2008 Jan;72(1):89-96. DOI: 10.1016/j.ijporl.2007.09.021
106. Jahnke K. Laser-Tonsillotomie, Wissensstand und offene Fragen [Laser-tonsillectomy, state of the art and open questions]. *Laryngorhinootologie*. 2005 Sep;84(9):651-2. DOI: 10.1055/s-2005-870376
107. Jensen A, Fagö-Olsen H, Sørensen CH, Kilian M. Molecular mapping to species level of the tonsillar crypt microbiota associated with health and recurrent tonsillitis. *PLoS ONE*. 2013;8(2):e56418. DOI: 10.1371/journal.pone.0056418
108. Jensen JH, Larsen SB. Treatment of recurrent acute tonsillitis with clindamycin - An alternative to tonsillectomy? *Clin Otolaryngol Allied Sci*. 1991 Oct;16(5):498-500. DOI: 10.1111/j.1365-2273.1991.tb01048.x
109. Kain ZN, Mayes LC, Caldwell-Andrews AA, Karas DE, McClain BC. Preoperative anxiety, postoperative pain, and behavioral recovery in young children undergoing surgery. *Pediatrics*. 2006 Aug;118(2):651-8. DOI: 10.1542/peds.2005-2920
110. Kamarauskas A, Dahl MR, Hlidarsdottir T, Mainz J, Ovesen T. Need for better analgesic treatment after tonsillectomy in ear, nose and throat practices. *Dan Med J*. 2013 May;60(5):A4639.
111. Kamin W, Maydannik VG, Malek FA, Kieser M. Efficacy and tolerability of EPs 7630 in patients (aged 6-18 years old) with acute bronchitis. *Acta Paediatr*. 2010 Apr;99(4):537-43. DOI: 10.1111/j.1651-2227.2009.01656.x
112. Kaplan EL. The group A streptococcal upper respiratory tract carrier state: an enigma. *J Pediatr*. 1980 Sep;97(3):337-45. DOI: 10.1016/S0022-3476(80)80178-8
113. Kaplan EL, Top FH Jr, Dudding BA, Wannamaker LW. Diagnosis of streptococcal pharyngitis: differentiation of active infection from the carrier state in the symptomatic child. *J Infect Dis*. 1971 May;123(5):490-501. DOI: 10.1093/infdis/123.5.490
114. Karaca CT, Toros SZ, Noşeri H, Külekcı S, Kalaycı C, Oysu C, Klıçođlu G, Eđeli E. Role of allergy in children with adenotonsillar hypertrophy. *J Craniofac Surg*. 2012 Nov;23(6):e611-3. DOI: 10.1097/SCS.0b013e31826cf562
115. Karlıdađ T, Bulut Y, Keleş E, Alpay HC, Seyrek A, Orhan İ, Karlıdađ GE, Kaygusuz İ. Presence of herpesviruses in adenoid tissues of children with adenoid hypertrophy and chronic adenoiditis. *Kulak Burun Bogaz İhtis Derg*. 2012 Jan-Feb;22(1):32-7. DOI: 10.5606/kbbihtisas.2012.006
116. Kaygusuz İ, Alpay HC, Gödekmerdan A, Karlıdađ T, Keleş E, Yalçın S, Demir N. Evaluation of long-term impacts of tonsillectomy on immune functions of children: a follow-up study. *Int J Pediatr Otorhinolaryngol*. 2009 Mar;73(3):445-9. DOI: 10.1016/j.ijporl.2008.11.014

117. Kaygusuz I, Gödekmerdan A, Karlıdag T, Keleş E, Yalçın S, Aral I, Yıldız M. Early stage impacts of tonsillectomy on immune functions of children. *Int J Pediatr Otorhinolaryngol*. 2003 Dec;67(12):1311-5. DOI: 10.1016/j.ijporl.2003.07.017
118. Kerdelmidis M, Lennon D, Arroll B, Peat B. Guidelines for sore throat management in New Zealand. *N Z Med J*. 2009 Aug;122(1301):10-8.
119. Klug TE, Henriksen JJ, Fuursted K, Ovesen T. Significant pathogens in peritonsillar abscesses. *Eur J Clin Microbiol Infect Dis*. 2011 May;30(5):619-27. DOI: 10.1007/s10096-010-1130-9
120. Klug TE, Henriksen JJ, Fuursted K, Ovesen T. Similar recovery rates of *Fusobacterium necrophorum* from recurrently infected and non-infected tonsils. *Dan Med Bull*. 2011 Jul;58(7):A4295.
121. Klug TE, Henriksen JJ, Rusan M, Fuursted K, Ovesen T. Bacteremia during quinsy and elective tonsillectomy: an evaluation of antibiotic prophylaxis recommendations for patients undergoing tonsillectomy. *J Cardiovasc Pharmacol Ther*. 2012 Sep;17(3):298-302. DOI: 10.1177/1074248411423023
122. Koltai PJ, Solares CA, Koempel JA, Hirose K, Abelson TI, Krakovitz PR, Chan J, Xu M, Mascha EJ. Intracapsular tonsillar reduction (partial tonsillectomy): reviving a historical procedure for obstructive sleep disordered breathing in children. *Otolaryngol Head Neck Surg*. 2003 Nov;129(5):532-8. DOI: 10.1016/S0194-5998(03)00727-7
123. Koltai PJ, Solares CA, Mascha EJ, Xu M. Intracapsular partial tonsillectomy for tonsillar hypertrophy in children. *Laryngoscope*. 2002 Aug;112(8 Pt 2 Suppl 100):17-9. DOI: 10.1002/lary.5541121407
124. Krespi YP, Kizhner V. Laser tonsil cryptolysis: in-office 500 cases review. *Am J Otolaryngol*. 2013 Sep-Oct;34(5):420-4. DOI: 10.1016/j.amjoto.2013.03.006
125. Kristensen S, Tveterås K. Post-tonsillectomy haemorrhage. A retrospective study of 1150 operations. *Clin Otolaryngol Allied Sci*. 1984 Dec;9(6):347-50. DOI: 10.1111/j.1365-2273.1984.tb01519.x
126. Kurien M, Stanis A, Job A, Brahmadathan , Thomas K. Throat swab in the chronic tonsillitis: how reliable and valid is it? *Singapore Med J*. 2000 Jul;41(7):324-6.
127. Lange G. Angina und chronische Tonsillitis-Indikationen zur Tonsillektomie [Angina and chronic tonsillitis-indications for tonsillectomy]. *Z Allgemeinmed*. 1973 Mar;49(8):366-70.
128. Lassaletta L, Martín G, Villafruela MA, Bolaños C, Alvarez-Vicent JJ. Pediatric tonsillectomy: post-operative morbidity comparing microsurgical bipolar dissection versus cold sharp dissection. *Int J Pediatr Otorhinolaryngol*. 1997 Sep;41(3):307-17. DOI: 10.1016/S0165-5876(97)00099-2
129. Lavy JA. Post-tonsillectomy pain: the difference between younger and older patients. *Int J Pediatr Otorhinolaryngol*. 1997 Oct;42(1):11-5. DOI: 10.1016/S0165-5876(97)00107-9
130. Lee PK, Schlievert PM. Molecular genetics of pyrogenic exotoxin "superantigens" of group A streptococci and *Staphylococcus aureus*. *Curr Top Microbiol Immunol*. 1991;174:1-19. DOI: 10.1007/978-3-642-50998-8_1
131. Leinbach RF, Markwell SJ, Colliver JA, Lin SY. Hot versus cold tonsillectomy: a systematic review of the literature. *Otolaryngol Head Neck Surg*. 2003 Oct;129(4):360-4. DOI: 10.1016/S0194-5998(03)00729-0
132. Lenz H. Raster-elektronenmikroskopische Beobachtungen an den menschlichen Tonsillen [Scanning electron microscope observations of human tonsils]. *Arch Klin Exp Ohren Nasen Kehlkopfheilkd*. 1971;199(2):509-604.
133. Lescanne E, Chiron B, Constant I, Couloigner V, Fauroux B, Hassani Y, Jouffroy L, Lesage V, Mondain M, Nowak C, Orliaguet G, Viot A; French Society of ENT (SFORL); French Association for Ambulatory Surgery (AFCa); French Society for Anaesthesia, Intensive Care (SFAR). Pediatric tonsillectomy: clinical practice guidelines. *Eur Ann Otorhinolaryngol Head Neck Dis*. 2012 Oct;129(5):264-71. DOI: 10.1016/j.anorl.2012.03.003
134. Lewis JS. Cryosurgery: its value and limitations. *Trans Pac Coast Otophthalmol Soc Annu Meet*. 1966;47:25-35.
135. Lewis SR, Nicholson A, Cardwell ME, Siviter G, Smith AF. Nonsteroidal anti-inflammatory drugs and perioperative bleeding in paediatric tonsillectomy. *Cochrane Database Syst Rev*. 2013;7:CD003591. DOI: 10.1002/14651858.CD003591.pub3
136. Linder A, Markström A, Hultcrantz E. Using the carbon dioxide laser for tonsillotomy in children. *Int J Pediatr Otorhinolaryngol*. 1999 Oct;50(1):31-6. DOI: 10.1016/S0165-5876(99)00197-4
137. Lister MT, Cunningham MJ, Benjamin B, Williams M, Tirrell A, Schaumberg DA, Hartnick CJ. Microdebrider tonsillotomy vs electro-surgical tonsillectomy: a randomized, double-blind, paired control study of postoperative pain. *Arch Otolaryngol Head Neck Surg*. 2006 Jun;132(6):599-604. DOI: 10.1001/archotol.132.6.599
138. Litalien C, Jacqz-Aigrain E. Risks and benefits of nonsteroidal anti-inflammatory drugs in children: a comparison with paracetamol. *Paediatr Drugs*. 2001;3(11):817-58. DOI: 10.2165/00128072-200103110-00004
139. López Ramos D, Gabriel R, Cantero Perona J, Moreno Otero R, Fernández Bermejo M, Maté Jiménez J. Association of MALTectomy (appendectomy and tonsillectomy) and inflammatory bowel disease: a familial case-control study. *Rev Esp Enferm Dig*. 2001 May;93(5):303-14.
140. Luebbers CW, Luebbers W. Die Roedermethode. *HNO Nachrichten*. 2010 Jan 1;1(2):57-9.
141. Luebbers W, Luebbers CW. Die Mandelguillotine von Fahnestock (1832). *HNO Nachrichten*. 2007 Jan 1;1:64-5.
142. Matanoski GM, Price WH, Ferencz C. Epidemiology of streptococcal infections in rheumatic and non-rheumatic families. II. The inter-relationship of streptococcal infections to age, family transmission and type of group A. *Am J Epidemiol*. 1968 Jan;87(1):190-206.
143. Matt BH, Krol BJ, Ding Y, Juliar BE. Effect of tonsillar fossa closure on postoperative pain and bleeding risk after tonsillectomy. *Int J Pediatr Otorhinolaryngol*. 2012 Dec;76(12):1799-805. DOI: 10.1016/j.ijporl.2012.09.004
144. Mitchelmore IJ, Reilly PG, Hay AJ, Tabaqchali S. Tonsil surface and core cultures in recurrent tonsillitis: prevalence of anaerobes and beta-lactamase producing organisms. *Eur J Clin Microbiol Infect Dis*. 1994 Jul;13(7):542-8. DOI: 10.1007/BF01971304
145. Moore N. Forty years of ibuprofen use. *Int J Clin Pract Suppl*. 2003 Apr;(135):28-31.
146. Mücke W, Huber HC, Ritter U. Mitteilung über die Keimbeseidlung der Gaumenmandeln bei gesunden Kindern im Einschulalter [The microbe colonization of the palatine tonsils of healthy school age children]. *Zentralbl Hyg Umweltmed*. 1994 Aug;196(1):70-4.
147. Nave H, Gebert A, Pabst R. Morphology and immunology of the human palatine tonsil. *Anat Embryol*. 2001 Nov;204(5):367-73. DOI: 10.1007/s004290100210
148. Nguyen CV, Parikh SR, Bent JP. Comparison of intraoperative bleeding between microdebrider intracapsular tonsillectomy and electrocautery tonsillectomy. *Ann Otol Rhinol Laryngol*. 2009 Oct;118(10):698-702.

149. Ohlsson A, Clark K. Antibiotics for sore throat to prevent rheumatic fever: yes or no? How the Cochrane Library can help. *CMAJ*. 2004 Sep;171(7):721-3. DOI: 10.1503/cmaj.1041275
150. Österreichische Gesellschaften für Hals-Nasen-Ohren-Heilkunde KuH, Kinder- und Jugendheilkunde. Gemeinsame Empfehlung zur Entfernung der Gaumenmandeln (Tonsillektomie). *Monatsschr Kinderheilkd*. 2008 Mar 7;3(156):268-71.
151. Ozkiriş M, Kapusuz Z, Saydam L. Comparison of ropivacaine, bupivacaine and lidocaine in the management of post-tonsillectomy pain. *Int J Pediatr Otorhinolaryngol*. 2012 Dec;76(12):1831-4. DOI: 10.1016/j.ijporl.2012.09.011
152. Paradise JL. Etiology and management of pharyngitis and pharyngotonsillitis in children: a current review. *Ann Otol Rhinol Laryngol Suppl*. 1992 Jan;155:51-7.
153. Paradise JL, Bluestone CD, Bachman RZ, Colborn DK, Bernard BS, Taylor FH, Rogers KD, Schwarzbach RH, Stool SE, Friday GA. Efficacy of tonsillectomy for recurrent throat infection in severely affected children. Results of parallel randomized and nonrandomized clinical trials. *N Engl J Med*. 1984 Mar;310(11):674-83. DOI: 10.1056/NEJM198403153101102
154. Paradise JL, Bluestone CD, Bachman RZ, Karantonis G, Smith IH, Saez CA, Colborn K, Bernard BS, Taylor FH, Schwarzbach RH, Felder H, Stool SE, Fitz AM, Rogers KD. History of recurrent sore throat as an indication for tonsillectomy. Predictive limitations of histories that are undocumented. *N Engl J Med*. 1978 Feb;298(8):409-13. DOI: 10.1056/NEJM197802232980801
155. Paradise JL, Bluestone CD, Colborn DK, Bernard BS, Rockette HE, Kurs-Lasky M. Tonsillectomy and adenotonsillectomy for recurrent throat infection in moderately affected children. *Pediatrics*. 2002 Jul;110(1 Pt 1):7-15. DOI: 10.1542/peds.110.1.7
156. Passos CA, Altemani A, Nicola JH, Nicola EM. Histopathological evaluation in biopsies of palatine tonsils submitted to cryptolysis by coagulation with CO2 laser for treatment of chronic caseous tonsillitis. *Photomed Laser Surg*. 2004 Jun;22(3):211-9. DOI: 10.1089/1549541041438605
157. Perry M, Whyte A. Immunology of the tonsils. *Immunol Today*. 1998 Sep;19(9):414-21. DOI: 10.1016/S0167-5699(98)01307-3
158. Perry ME, Jones MM, Mustafa Y. Structure of the crypt epithelium in human palatine tonsils. *Acta Otolaryngol Suppl*. 1988;454:53-9. DOI: 10.3109/00016488809125005
159. Perry ME, Slípka J. Formation of the tonsillar corpuscle. *Funct Dev Morphol*. 1993;3(3):165-8. DOI: 10.3109/00016488809125005
160. Pfaar O, Spielhaupter M, Schirkowski A, Wrede H, Mösges R, Hörmann K, Klimek L. Treatment of hypertrophic palatine tonsils using bipolar radiofrequency-induced thermotherapy (RFITT). *Acta Otolaryngol*. 2007 Nov;127(11):1176-81. DOI: 10.1080/00016480701242428
161. Piacentini GL, Peroni DG, Blasi F, Pescollderung L, Goller P, Gallmetzer L, Drago L, Bodini A, Boner AL. Atypical bacteria in adenoids and tonsils of children requiring adenotonsillectomy. *Acta Otolaryngol*. 2010 May;130(5):620-5. DOI: 10.3109/00016480903359921
162. Plant RL. Radiofrequency treatment of tonsillar hypertrophy. *Laryngoscope*. 2002 Aug;112(8 Pt 2 Suppl 100):20-2. DOI: 10.1002/lary.5541121408
163. Poller K, Volk GF, Wittekindt C, Meissner W, Guntinas-Lichius O. Verbesserung der Schmerztherapie nach Tonsillektomie bei Erwachsenen durch Schmerzmessung mit QUIPS ("Qualitätsverbesserung in der postoperativen Schmerztherapie") [Estimation of postoperative pain after tonsillectomy in adults using QUIPS: an instrument to improve postoperative pain management]. *Laryngorhinotologie*. 2011 Feb;90(2):82-9. DOI: 10.1055/s-0030-1269848
164. Powell EL, Powell J, Samuel JR, Wilson JA. A review of the pathogenesis of adult peritonsillar abscess: time for a re-evaluation. *J Antimicrob Chemother*. 2013 Sep;68(9):1941-50. DOI: 10.1093/jac/dkt128
165. Powell J, Wilson JA. An evidence-based review of peritonsillar abscess. *Clin Otolaryngol*. 2012 Apr;37(2):136-45. DOI: 10.1111/j.1749-4486.2012.02452.x
166. Principato JJ. Cryosurgical treatment of the lymphoid tissue of Waldeyer's ring. *Otolaryngol Clin North Am*. 1987 May;20(2):365-70.
167. Proenca-Modena JL, Pereira Valera FC, Jacob MG, Buzatto GP, Saturno TH, Lopes L, Souza JM, Escremin Paula F, Silva ML, Carezzi LR, Tamashiro E, Arruda E, Anselmo-Lima WT. High rates of detection of respiratory viruses in tonsillar tissues from children with chronic adenotonsillar disease. *PLoS ONE*. 2012;7(8):e42136. DOI: 10.1371/journal.pone.0042136
168. Ramírez-Camacho R, González-Tallón AI, Gómez D, Trinidad A, Ibáñez A, García-Berrocal JR, Verdaguer JM, González-García JA, San Román J. Microscopia electrónica de barrido ambiental para la detección de biopelículas en las amígdalas [Environmental scanning electron microscopy for biofilm detection in tonsils]. *Acta Otorrinolaringol Esp*. 2008 Jan;59(1):16-20. DOI: 10.1016/S0001-6519(08)73252-7
169. Randel A. AAO-HNS Guidelines for Tonsillectomy in Children and Adolescents. *Am Fam Physician*. 2011 Sep;84(5):566-73.
170. Rapkin RH. Tonsils and rheumatic fever. *N Engl J Med*. 1970 Apr;282(14):814. DOI: 10.1056/NEJM197004022821423
171. Raut VV. Management of peritonsillitis/peritonsillar. *Rev Laryngol Otol Rhinol (Bord)*. 2000;121(2):107-10.
172. Reichel O, Mayr D, Winterhoff J, de la Chaux R, Hagedorn H, Berghaus A. Tonsillotomy or tonsillectomy?—a prospective study comparing histological and immunological findings in recurrent tonsillitis and tonsillar hyperplasia. *Eur Arch Otorhinolaryngol*. 2007 Mar;264(3):277-84. DOI: 10.1007/s00405-006-0162-3
173. Reilly BK, Levin J, Sheldon S, Harsanyi K, Gerber ME. Efficacy of microdebrider intracapsular adenotonsillectomy as validated by polysomnography. *Laryngoscope*. 2009 Jul;119(7):1391-3. DOI: 10.1002/lary.20257
174. Reinert RR. Streptokokken-Infektionen - Aktuelle Aspekte zur Diagnostik, Prophylaxe und Therapie. 1st ed. Bremen: Uni-Med-Science; 2007.
175. Rigglin L, Ramakrishna J, Sommer DD, Koren G. A 2013 updated systematic review & meta-analysis of 36 randomized controlled trials; no apparent effects of non steroidal anti-inflammatory agents on the risk of bleeding after tonsillectomy. *Clin Otolaryngol*. 2013 Apr;38(2):115-29. DOI: 10.1111/coa.12106
176. Robb PJ, Bew S, Kubba H, Murphy N, Primhak R, Rollin AM, Tremlett M. Tonsillectomy and adenoidectomy in children with sleep-related breathing disorders: consensus statement of a UK multidisciplinary working party. *Ann R Coll Surg Engl*. 2009 Jul;91(5):371-3. DOI: 10.1308/003588409X432239
177. Roberts AL, Connolly KL, Kirse DJ, Evans AK, Poehling KA, Peters TR, Reid SD. Detection of group A Streptococcus in tonsils from pediatric patients reveals high rate of asymptomatic streptococcal carriage. *BMC Pediatr*. 2012;12:3. DOI: 10.1186/1471-2431-12-3
178. Rømsing J, Ostergaard D, Drozdiewicz D, Schultz P, Ravn G. Diclofenac or acetaminophen for analgesia in paediatric tonsillectomy outpatients. *Acta Anaesthesiol Scand*. 2000 Mar;44(3):291-5. DOI: 10.1034/j.1399-6576.2000.440312.x
179. Rømsing J, Ostergaard D, Walther-Larsen S, Valentin N. Analgesic efficacy and safety of preoperative versus postoperative ketorolac in paediatric tonsillectomy. *Acta Anaesthesiol Scand*. 1998 Aug;42(7):770-5. DOI: 10.1111/j.1399-6576.1998.tb05320.x

180. Rotenberg BW, Wickens B, Parnes J. Intraoperative ice pack application for uvulopalatoplasty pain reduction: a randomized controlled trial. *Laryngoscope*. 2013 Feb;123(2):533-6. DOI: 10.1002/lary.23627
181. Ruiss R, Jochum S, Wanner G, Reisbach G, Hammerschmidt W, Zeidler R. A virus-like particle-based Epstein-Barr virus vaccine. *J Virol*. 2011 Dec;85(24):13105-13. DOI: 10.1128/JVI.05598-11
182. Rusan M, Klug TE, Henriksen JJ, Ellermann-Eriksen S, Fursted K, Ovesen T. The role of viruses in the pathogenesis of peritonsillar abscess. *Eur J Clin Microbiol Infect Dis*. 2012 Sep;31(9):2335-43. DOI: 10.1007/s10096-012-1573-2
183. Sadeghi-Shabestari M, Jabbari Moghaddam Y, Ghaharri H. Is there any correlation between allergy and adenotonsillar tissue hypertrophy? *Int J Pediatr Otorhinolaryngol*. 2011 Apr;75(4):589-91. DOI: 10.1016/j.ijporl.2011.01.026
184. Sadhasivam S, Chidambaran V, Ngamprasertwong P, Esslinger HR, Prows C, Zhang X, Martin LJ, McAuliffe J. Race and unequal burden of perioperative pain and opioid related adverse effects in children. *Pediatrics*. 2012 May;129(5):832-8. DOI: 10.1542/peds.2011-2607
185. Salam MA, Cable HR. Post-tonsillectomy pain with diathermy and ligation techniques. A prospective randomized study in children and adults. *Clin Otolaryngol Allied Sci*. 1992 Dec;17(6):517-9. DOI: 10.1111/j.1365-2273.1992.tb01709.x
186. Sampaio AL, Pinheiro TG, Furtado PL, Araújo MF, Oliveira CA. Evaluation of early postoperative morbidity in pediatric tonsillectomy with the use of sucralfate. *Int J Pediatr Otorhinolaryngol*. 2007 Apr;71(4):645-51. DOI: 10.1016/j.ijporl.2006.12.016
187. Sarny S, Habermann W, Ossimitz G, Schmid C, Stammberger H. Tonsillar haemorrhage and re-admission: a questionnaire based study. *Eur Arch Otorhinolaryngol*. 2011 Dec;268(12):1803-7. DOI: 10.1007/s00405-011-1541-y
188. Sarny S, Habermann W, Ossimitz G, Stammberger H. Significant post-tonsillectomy pain is associated with increased risk of hemorrhage. *Ann Otol Rhinol Laryngol*. 2012 Dec;121(12):776-81.
189. Sarny S, Habermann W, Ossimitz G, Stammberger H. "Die Österreichische Tonsillenstudie 2010" - Teil 2: Postoperative Blutungen [The Austrian Tonsil Study 2010 - Part 2: Postoperative haemorrhage]. *Laryngorhinootologie*. 2012 Feb;91(2):98-102. DOI: 10.1055/s-0031-1291309
190. Sarny S, Ossimitz G, Habermann W, Stammberger H. Hemorrhage following tonsil surgery: a multicenter prospective study. *Laryngoscope*. 2011 Dec;121(12):2553-60. DOI: 10.1002/lary.22347
191. Sarny S, Ossimitz G, Habermann W, Stammberger H. Die Österreichische Tonsillenstudie 2010 Teil 1: Statistischer Überblick [The Austrian tonsil study 2010-part 1: statistical overview]. *Laryngorhinootologie*. 2012 Jan;91(1):16-21. DOI: 10.1055/s-0031-1291310
192. Sarny S, Ossimitz G, Habermann W, Stammberger H. Die Österreichische Tonsillenstudie Teil 3: Operationstechnik und Nachblutung nach Tonsillektomie [Austrian tonsil study part 3: surgical technique and postoperative haemorrhage after tonsillectomy]. *Laryngorhinootologie*. 2013 Feb;92(2):92-6. DOI: 10.1055/s-0032-1330031
193. Scherer H. Tonsillotomie versus Tonsillektomie [Tonsillotomy versus tonsillectomy]. *Laryngorhinootologie*. 2003 Nov;82(11):754-5. DOI: 10.1055/s-2003-44535
194. Scherer H, Fuhrer A, Hopf J, Linnarz M, Philipp C, Wermund K, Wigand I. Derzeitiger Stand der Laserchirurgie im Bereich des weichen Gaumens und der angrenzenden Regionen [Current status of laser surgery in the area of the soft palate and adjoining regions]. *Laryngorhinootologie*. 1994 Jan;73(1):14-20. DOI: 10.1055/s-2007-997073
195. Schwaab M, Gurr A, Hansen S, Minovi AM, Thomas JP, Sudhoff H, Dazert S. Human beta-Defensins in different states of diseases of the tonsilla palatina. *Eur Arch Otorhinolaryngol*. 2010 May;267(5):821-30. DOI: 10.1007/s00405-009-1086-5
196. Segal N, El-Saied S, Puterman M. Peritonsillar abscess in children in the southern district of Israel. *Int J Pediatr Otorhinolaryngol*. 2009 Aug;73(8):1148-50. DOI: 10.1016/j.ijporl.2009.04.021
197. Segal N, Puterman M, Rotem E, Niv A, Kaplan D, Kraus M, Brenner H, Nash M, Tal A, Leiberman A. A prospective randomized double-blind trial of fibrin glue for reducing pain and bleeding after tonsillectomy. *Int J Pediatr Otorhinolaryngol*. 2008 Apr;72(4):469-73. DOI: 10.1016/j.ijporl.2007.12.011
198. Semberova J, Rychly B, Hanzelova J, Jakubikova J. The immune status in situ of recurrent tonsillitis and idiopathic tonsillar hypertrophy. *Bratisl Lek Listy*. 2013;114(3):140-4.
199. Senska G, Schröder H, Pütter C, Dost P. Significantly reducing post-tonsillectomy haemorrhage requiring surgery by suturing the faucial pillars: a retrospective analysis. *PLoS ONE*. 2012;7(10):e47874. DOI: 10.1371/journal.pone.0047874
200. Shulman ST, Bisno AL, Clegg HW, Gerber MA, Kaplan EL, Lee G, Martin JM, Van Beneden C; Infectious Diseases Society of America. Clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2012 Nov;55(10):e86-102. DOI: 10.1093/cid/cis629
201. Shulman ST, Tanz RR, Dale JB, Beall B, Kabat W, Kabat K, Cederlund E, Patel D, Rippe J, Li Z, Sakota V; North American Streptococcal Pharyngitis Surveillance Group. Seven-year surveillance of north american pediatric group A streptococcal pharyngitis isolates. *Clin Infect Dis*. 2009 Jul;49(1):78-84. DOI: 10.1086/599344
202. Sobol SE, Wetmore RF, Marsh RR, Stow J, Jacobs IN. Postoperative recovery after microdebrider intracapsular or monopolar electrocautery tonsillectomy: a prospective, randomized, single-blinded study. *Arch Otolaryngol Head Neck Surg*. 2006 Mar;132(3):270-4. DOI: 10.1001/archotol.132.3.270
203. Sorin A, Bent JP, April MM, Ward RF. Complications of microdebrider-assisted powered intracapsular tonsillectomy and adenoidectomy. *Laryngoscope*. 2004 Feb;114(2):297-300. DOI: 10.1097/00005537-200402000-00022
204. Stanko D, Bergesio R, Davies K, Hegarty M, von Ungern-Sternberg BS. Postoperative pain, nausea and vomiting following adeno-tonsillectomy - a long-term follow-up. *Paediatr Anaesth*. 2013 Aug;23(8):690-6. DOI: 10.1111/pan.12170
205. Stelter K, de la Chau R, Patscheider M, Olzowy B. Double-blind, randomised, controlled study of post-operative pain in children undergoing radiofrequency tonsillotomy versus laser tonsillotomy. *J Laryngol Otol*. 2010 Aug;124(8):880-5. DOI: 10.1017/S0022215110000605
206. Stelter K, Hempel JM, Berghaus A, Andratschke M, Luebbers CW, Hagedorn H. Application methods of local anaesthetic infiltrations for postoperative pain relief in tonsillectomy: a prospective, randomised, double-blind, clinical trial. *Eur Arch Otorhinolaryngol*. 2009 Oct;266(10):1615-20. DOI: 10.1007/s00405-008-0909-0

207. Stelter K, Hiller J, Hempel JM, Berghaus A, Hagedorn H, Andratschke M, Canis M. Comparison of two different local anaesthetic infiltrations for postoperative pain relief in tonsillectomy: a prospective, randomised, double blind, clinical trial. *Eur Arch Otorhinolaryngol*. 2010 Jul;267(7):1129-34. DOI: 10.1007/s00405-009-1200-8
208. Stelter K, Ihrler S, Siedek V, Patscheider M, Braun T, Ledderose G. 1-year follow-up after radiofrequency tonsillectomy and laser tonsillectomy in children: a prospective, double-blind, clinical study. *Eur Arch Otorhinolaryngol*. 2012 Feb;269(2):679-84. DOI: 10.1007/s00405-011-1681-0
209. Steward DL, Grisel J, Meinzen-Derr J. Steroids for improving recovery following tonsillectomy in children. *Cochrane Database Syst Rev*. 2011;(8):CD003997. DOI: 10.1002/14651858.CD003997.pub2
210. Stryjecki J. Tonsilektomia w przebiegu choroby reumatycznej u dzieci [Tonsillectomy in the course of rheumatic fever in children]. *Pediatr Pol*. 1968 Dec;43(12):1531-4.
211. Stuck BA, Abrams J, de la Chaux R, Dreher A, Heiser C, Hohenhorst W, Kühnel T, Maurer JT, Pirsig W, Steffen A, Verse T; ArGe Schlafmedizin der Deutschen Gesellschaft für Hals-Nasen-Ohren-Heilkunde, Kopf- und Hals-Chirurgie e.V. S1-Leitlinie "Diagnostik und Therapie des Schnarchens des Erwachsenen" [S1 guideline on the "diagnosis and treatment of snoring in adults"]. *HNO*. 2010 Mar;58(3):272-8. DOI: 10.1007/s00106-010-2103-0
212. Stuck BA, Genzwürker HV. Tonsillektomie bei Kindern: präoperative evaluation von risikofaktoren [Tonsillectomy in children: preoperative evaluation of risk factors]. *Anaesthesist*. 2008 May;57(5):499-504. DOI: 10.1007/s00101-008-1337-7
213. Stuck BA, Götte K, Windfuhr JP, Genzwürker H, Schrotten H, Tenenbaum T. Tonsillectomy in children. *Dtsch Arztebl Int*. 2008 Dec;105(49):852-60. DOI: 10.3238/arztebl.2008.0852
214. Sun GH, Auger KA, Aliu O, Patrick SW, DeMonner S, Davis MM. Posttonsillectomy hemorrhage in children with von Willebrand disease or hemophilia. *JAMA Otolaryngol Head Neck Surg*. 2013 Mar;139(3):245-9. DOI: 10.1001/jamaoto.2013.1821
215. Sutters KA, Miaskowski C, Holdridge-Zeuner D, Waite S, Paul SM, Savedra MC, Lanier B. A randomized clinical trial of the effectiveness of a scheduled oral analgesic dosing regimen for the management of postoperative pain in children following tonsillectomy. *Pain*. 2004 Jul;110(1-2):49-55. DOI: 10.1016/j.pain.2004.03.008
216. Swidsinski A, Göktas O, Bessler C, Loening-Baucke V, Hale LP, Andree H, Weizenegger M, Hölzl M, Scherer H, Lochs H. Spatial organisation of microbiota in quiescent adenoiditis and tonsillitis. *J Clin Pathol*. 2007 Mar;60(3):253-60. DOI: 10.1136/jcp.2006.037309
217. Sylvester DC, Rafferty A, Bew S, Knight LC. The use of ice-lollies for pain relief post-paediatric tonsillectomy. A single-blinded, randomised, controlled trial. *Clin Otolaryngol*. 2011 Dec;36(6):566-70. DOI: 10.1111/j.1749-4486.2011.02410.x
218. Tanz RR, Shulman ST. Chronic pharyngeal carriage of group A streptococci. *Pediatr Infect Dis J*. 2007 Feb;26(2):175-6. DOI: 10.1097/01.inf.0000255328.19808.be
219. Tanz RR, Shulman ST. Streptococcal pharyngitis: the carrier state, definition, and management. *Pediatr Ann*. 1998 May;27(5):281-5. DOI: 10.3928/0090-4481-19980501-07
220. Tekelioglu UY, Apuhan T, Akkaya A, Demirhan A, Yildiz I, Simsek T, Gok U, Kocoglu H. Comparison of topical tramadol and ketamine in pain treatment after tonsillectomy. *Paediatr Anaesth*. 2013 Jun;23(6):496-501. DOI: 10.1111/pan.12148
221. Torretta S, Drago L, Marchisio P, Cappadona M, Rinaldi V, Nazzari E, Pignataro L. Recurrences in chronic tonsillitis sustained by tonsillar biofilm-producing bacteria in children. Relationship with the grade of tonsillar hyperplasia. *Int J Pediatr Otorhinolaryngol*. 2013 Feb;77(2):200-4. DOI: 10.1016/j.ijporl.2012.10.018
222. Unkel C, Lehnerdt G, Schmitz KJ, Jahnke K. Laser-tonsillectomy for treatment of obstructive tonsillar hyperplasia in early childhood: a retrospective review. *Int J Pediatr Otorhinolaryngol*. 2005 Dec;69(12):1615-20. DOI: 10.1016/j.ijporl.2005.08.017
223. Vallée E, Lafrenaye S, Tétrault JP, Mayer S, Dorion D. Pain management after tonsillectomy: morphine is not enough. *J Otolaryngol Head Neck Surg*. 2008 Apr;37(2):279-84.
224. Van Den Akker EH, Hoes AW, Burton MJ, Schilder AG. Large international differences in (adeno)tonsillectomy rates. *Clin Otolaryngol Allied Sci*. 2004 Apr;29(2):161-4. DOI: 10.1111/j.0307-7772.2004.00771.x
225. van den Anker JN. Optimising the management of fever and pain in children. *Int J Clin Pract Suppl*. 2013 Jan;(178):26-32. DOI: 10.1111/ijcp.12056
226. van Driel ML, De Sutter AI, Keber N, Habraken H, Christiaens T. Different antibiotic treatments for group A streptococcal pharyngitis. *Cochrane Database Syst Rev*. 2013;4:CD004406. DOI: 10.1002/14651858.CD004406.pub3
227. Vaughan AH, Derkay CS. Microdebrider intracapsular tonsillectomy. *ORL J Otorhinolaryngol Relat Spec*. 2007;69(6):358-63. DOI: 10.1159/000108368
228. Verschuur HP, Raats CJ, Rosenbrand CJ; Dutch Association of Otolaryngology and Head & Neck Surgery; Dutch Institute for Healthcare Improvement. Richtlijn 'Ziekten van adenoid en tonsillen in de tweede lijn' [Practice guideline 'Adenoid and tonsil disorders in secondary care']. *Ned Tijdschr Geneesk*. 2009;153:B295.
229. Walther LE, Ilgner J, Oehme A, Schmidt P, Sellhaus B, Gudziol H, Beleites E, Westhofen M. Die infektiöse Mononukleose [Infectious mononucleosis]. *HNO*. 2005 Apr;53(4):383-92; quiz 393. DOI: 10.1007/s00106-004-1210-1
230. Walton J, Ebner Y, Stewart MG, April MM. Systematic review of randomized controlled trials comparing intracapsular tonsillectomy with total tonsillectomy in a pediatric population. *Arch Otolaryngol Head Neck Surg*. 2012 Mar;138(3):243-9. DOI: 10.1001/archoto.2012.16
231. Wannamaker LW. Tonsils, rheumatic fever and health delivery. *N Engl J Med*. 1970 Feb;282(6):336-7. DOI: 10.1056/NEJM197002052820610
232. Watson MG, Dawes PJ, Samuel PR, Marshall HF, Rayappa C, Hill J, Meikle D, Murty GE, Deans JA, Telios G. A study of haemostasis following tonsillectomy comparing ligatures with diathermy. *J Laryngol Otol*. 1993 Aug;107(8):711-5. DOI: 10.1017/S0022215100124211
233. Wessels MR. Clinical practice. Streptococcal pharyngitis. *N Engl J Med*. 2011 Feb;364(7):648-55. DOI: 10.1056/NEJMc1009126
234. Westermann J. *Organe des Abwehrsystems*. Berlin, Heidelberg: Springer; 2010. p. 361-2.
235. Wienke A. Tonsillektomie vs. Tonsillotomie. Rechtliche Aspekte zu einem aktuellen Thema. *HNO Informationen*. 2013 Jun 1;3:101-2.
236. Windfuhr JP. Fehler und Gefahren: tonsillektomie und andere Standard-Eingriffe [Faults and failure of tonsil surgery and other standard procedures in otorhinolaryngology]. *Laryngorhinootologie*. 2013 Apr;92 Suppl 1:S33-72. DOI: 10.1055/s-0032-1333253

237. Windfuhr JP, Chen YS, Propst EJ, Güldner C. The effect of dexamethasone on post-tonsillectomy nausea, vomiting and bleeding. *Braz J Otorhinolaryngol*. 2011 Jun;77(3):373-9. DOI: 10.1590/S1808-86942011000300017
238. Windfuhr JP, Chen YS, Remmert S. Hemorrhage following tonsillectomy and adenoidectomy in 15,218 patients. *Otolaryngol Head Neck Surg*. 2005 Feb;132(2):281-6. DOI: 10.1016/j.otohns.2004.09.007
239. Windfuhr JP, Remmert S. Peritonsillarabszess Trends und Komplikationen bei der Behandlung, insbesondere bei Kindern [Trends and complications in the management of peritonsillar abscess with emphasis on children]. *HNO*. 2005 Jan;53(1):46-57. DOI: 10.1007/s00106-003-1036-2
240. Windfuhr JP, Schloendorff G, Baburi D, Kremer B. Life-threatening posttonsillectomy hemorrhage. *Laryngoscope*. 2008 Aug;118(8):1389-94. DOI: 10.1097/MLG.0b013e3181734f7e
241. Windfuhr JP, Schloendorff G, Baburi D, Kremer B. Serious post-tonsillectomy hemorrhage with and without lethal outcome in children and adolescents. *Int J Pediatr Otorhinolaryngol*. 2008 Jul;72(7):1029-40. DOI: 10.1016/j.ijporl.2008.03.009
242. Windfuhr JP, Schloendorff G, Sesterhenn AM, Prescher A, Kremer B. A devastating outcome after adenoidectomy and tonsillectomy: ideas for improved prevention and management. *Otolaryngol Head Neck Surg*. 2009 Feb;140(2):191-6. DOI: 10.1016/j.otohns.2008.11.012
243. Windfuhr JP, Werner JA. Tonsillotomy: it's time to clarify the facts. *Eur Arch Otorhinolaryngol*. 2013 Nov;270(12):2985-96. DOI: 10.1007/s00405-013-2577-y
244. Windfuhr JP, Wienke A, Chen YS. Electrosurgery as a risk factor for secondary post-tonsillectomy hemorrhage. *Eur Arch Otorhinolaryngol*. 2009 Jan;266(1):111-6. DOI: 10.1007/s00405-008-0720-y
245. Witmer CM, Elden L, Butler RB, Manno CS, Raffini LJ. Incidence of bleeding complications in pediatric patients with type 1 von Willebrand disease undergoing adenotonsillar procedures. *J Pediatr*. 2009 Jul;155(1):68-72. DOI: 10.1016/j.jpeds.2009.01.051
246. Zagorianskaia ME, Kibort RV, Tsyru'nikov MD, Shibanova EM. Dinamika immunologicheskikh pokazatelei pod vlianiem kriovozdeistviia na nebnye mindaliny [Dynamics of the immunological indices as affected by cryotherapy of the palatine tonsils]. *Vestn Otorinolaringol*. 1984 Jul-Aug;(4):40-3.
247. Zernikow B, Smale H, Michel E, Hasan C, Jorch N, Andler W. Paediatric cancer pain management using the WHO analgesic ladder—results of a prospective analysis from 2265 treatment days during a quality improvement study. *Eur J Pain*. 2006 Oct;10(7):587-95. DOI: 10.1016/j.ejpain.2005.09.002
248. Zesewitz PS, Stelter K. Blutungskomplikationen bei Adenotomien und Tonsillektomien im Kindes- und Jugendalter: Eine bayern- und saarlandweite Umfrage unter den niedergelassenen HNO-Ärzten zur Häufigkeit, Vorhersagbarkeit und Ursachen. München: Medizinische Fakultät; 2012.
249. Zhu X, Yang H, Chen X, Jin Y, Fan Y. [Temperature-controlled radiofrequency-assisted endoscopic tonsillectomy and adenoidectomy in children]. *Lin Chung Er Bi Yan Hou Tou Jing Wai Ke Za Zhi*. 2011 Jun;25(12):551-3.

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