



SNLG15

**Appropriateness and safety
of tonsillectomy and/or adenoidectomy**

GUIDELINES

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Editing

Enrico Materia, Sergio Marletta, Laziosanità-Agenzia di Sanità Pubblica, Roma

Simona Calmi, Zadig, Milano

Translation

Eleonora Lacorte

Appropriateness and safety of tonsillectomy and/or adenoidectomy

Presentation

Five years after the publication of the PNLG document “The clinical and organizational appropriateness of tonsillectomy and adenoidectomy”, the new updated guideline, including graded recommendations is now available. The issue of safety has been associated to that of appropriateness, even in the title of this new document: tonsillectomy is to be considered as an “intermediate” surgery and implies significant risks of morbidity and postoperative complications. Appropriateness and safety of adenotonsillectomy are thus to be considered as two integrated dimensions that have to be faced carefully in clinical practice.

The main changes in this new document refer to diagnosis and indications to adenotonsillectomy for obstructive apnoea in children, differences between the various surgical techniques in relation to the risk of postoperative haemorrhage, available evidence on the effectiveness of treatments to be used in the perioperative period, and postoperative complications. More generally, several clinical studies and new evidence have been published in a relatively short time on some of the treated issues, highlighting the importance of regularly updating guidelines.

The relevance of the impact the document had after being implemented through several combined interventions, has to be underlined: the decrease in number of tonsillectomy in Italy brought a reduction in the variability of regional rates, suggesting a more appropriate use of this procedure.

The document contributed also to reinforce multi-professional cooperation, now crucial in particular between ear, nose and throat (ENT) specialists and paediatricians, and to improve the dissemination of the Evidence-based medicine approach.

The guideline is made of four main sections focused on tonsillectomy and adenoidectomy interventions, surgical and anaesthesiological techniques, perioperative management of tonsillectomy patients, and on clinical and organizational aspects. The multidisciplinary panel drew up recommendations answering to all questions to be updated for each of these issues, on the basis of available evidence. The resulting material aims at representing an instrument supporting clinical decisions to increase appropriateness and safety of adenotonsillectomy.

Authors

Luisa Bellussi, Clinica ORL, Università di Siena; Presidente Società italiana ORL pediatrica
Paolo Busoni, UO Anestesia e rianimazione, Ospedale pediatrico A. Meyer, Firenze
Angelo Camaioni, UO ORL, AO San Giovanni, Roma; Presidente Associazione otorinolaringoiatria ospedalieri italiani
Caterina Malagola, UO Odontoiatria, AO Sant'Andrea, Roma
Paola Marchisio, Istituto di pediatria, Fondazione IRCCS Ospedale Maggiore Policlinico Mangiagalli e Regina Elena, Milano
Sergio Marletta, Laziosanità-Agenzia di sanità pubblica, Roma
Federico Marolla, Associazione culturale pediatri, Roma
Enrico Materia, Laziosanità-Agenzia di sanità pubblica, Roma
Giulio Nati, Presidente SIMG Roma
Eugenio Pallesstrini, Dipartimento regionale testa collo, Clinica ORL, Ospedale San Martino, Genova; Past President Società Italiana ORL pediatrica
Lodovico Perletti, Società italiana di pediatria; Commissione LEA Ministero della Salute, Roma
Alberto Rinaldi Ceroni, UO ORL, Policlinico Sant'Orsola-Malpighi, Università di Bologna; Past President Associazione otorinolaringoiatri universitari italiani
Rocco Romano, UO Anestesia e rianimazione, Università politecnica delle Marche, Ancona
Albina Rumeo, Sistema Nazionale per le linee guida, Istituto Superiore di Sanità, Roma
Letizia Sampaolo, Sistema Nazionale per le linee guida, Istituto Superiore di Sanità, Roma
Francesco Tempesta, Coordinamento nazionale associazione malati cronici, CittadinanzAttiva – Tribunale per i diritti del malato, Roma
Alessandro Vigo, Centro SIDS, Ospedale Nuovo Regina Margherita, Torino
Maria Pia Villa, Clinica pediatrica, AO Sant'Andrea, Roma; Gruppo di studio SIP medicina del sonno

Referee

Salvatore Conticello, Clinica ORL, Università di Torino; Presidente Società italiana di otorinolaringologia e chirurgia cervico-facciale
Michele De Benedetto, UO ORL, AO Fazi, Lecce; Past President Società italiana di otorinolaringologia e chirurgia cervicofacciale
Maurizio De Martino, Dipartimento di pediatria, Ospedale pediatrico A. Meyer, Firenze; Presidente Società infettivologia pediatrica
Pasquale Di Pietro, UO Emergenza urgenza pediatrica, AO Gaslini, Genova; Presidente Società italiana di pediatria
Tommaso Langiano, Ospedale pediatrico Bambino Gesù, Roma
Anna Maria Marata, CeVEAS, Modena
Desiderio Passali, Clinica ORL, Università di Siena; Federazione internazionale società di ORL

Collaborators

Rosaria Cammarano, Servizio documentazione, Istituto Superiore di Sanità, Roma
Stefania Cardo, Laziosanità-Agenzia di sanità pubblica, Roma
Eliana Ferroni, Laziosanità-Agenzia di sanità pubblica, Roma
Lorenza Rossi, Laziosanità-Agenzia di sanità pubblica, Roma
Riccardo Di Domenicantonio, Laziosanità-Agenzia di sanità pubblica, Roma
Roberta Macci, Laziosanità-Agenzia di sanità pubblica, Roma
Sandra Magliolo, Laziosanità-Agenzia di sanità pubblica, Roma
Alessia Tiberio, Laziosanità-Agenzia di sanità pubblica, Roma

Scientific Associations

Associazione culturale pediatri (ACP)

Associazione italiana medicina del sonno (AIMS)

Associazione otorino laringologi ospedalieri italiani (AOOI)

Associazione universitaria otorino laringologi (AUORL)

Federazione internazionale società di ORL (IFOS)

Gruppo di studio SIP medicina del sonno (MDRS-SIDS)

Società italiana di anestesia analgesia rianimazione e terapia intensiva (SIAARTI)

Società italiana di infettivologia pediatrica (SITIP)

Società italiana di medicina generale (SIMG)

Società italiana di otorinolaringoiatria e chirurgia cervico-facciale (SIOeChCF)

Società italiana di otorino laringologia pediatrica (SIOP)

Società italiana di pediatria (SIP)

Conflict of interests

Authors state they are not in a condition causing professional judgments in relation to the validity of examined studies to be influenced by other interests such as economical or personal advantages.

LEVELS OF EVIDENCE

Evidence type

- I** Evidence from randomized controlled clinical trials and/or systematic reviews of randomized trials.
- II** Evidence from one single adequately designed randomized trial.
- III** Evidence from non-randomized cohort studies with concurrent or historical control or their metaanalysis.
- IV** Evidence from non-controlled retrospective case-control studies.
- V** Evidence from non-controlled case-series studies
- VI** Evidence from experts' opinions or opinions from panels as indicated in guidelines or consensus conferences, or based on opinions from members of the work group responsible for this guideline.

STRENGTH OF RECOMMENDATIONS

- A** Carrying out the specified procedure or diagnostic test is strongly recommended. The recommendation is supported by good-quality evidence, even if not necessarily type I or II.
- B** It would be inappropriate to always recommend the specified procedure or intervention, considered the still existing doubts, but it should anyway carefully considered.
- C** Significant uncertainties exist against recommending to carry out the specified procedure or intervention.
- D** The specified procedure is not recommended.
- E** The specified procedure is strongly not recommended.

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Summary

Indications to tonsillectomy and/or adenoidectomy

The main indications to tonsillectomy and/or adenoidectomy are: obstructive sleep apnea syndrome (OSAS) in children with adenotonsillar hypertrophy and severe recurrent tonsillitis.

The diagnosis of OSAS is based on clinical history, objective examination and nocturnal pulse oximetry, which is the first diagnostic test to be carried out to assess respiratory sleep disorders in children. Polysomnography should be carried out after a period of watchful waiting in case pulse oximetry does not result conclusive, once repeated after 3-6 months. Adenotonsillectomy in children with OSAS should be carried out in a relatively short time to avoid consequences on their cognitive development.

Severe recurrent tonsillitis is an indication to tonsillectomy only in case the patient suffers from five or more invalidating episodes of tonsillitis per annum, when observed for at least one year. These criteria can be adapted to the clinical situation of patients with complications such as peritonsillar abscess.

Adenoidectomy can be part of the treatment of chronic otitis media with effusion associated with chronic adenoiditis, and in the treatment of recurrent acute otitis media associated with adenoid hypertrophy obstructing tube orifice.

Surgical techniques

The use of “cold” dissection is recommended, due to the lower risk of postoperative hemorrhage if compared with diathermy and radiofrequency. A careful use of bipolar diathermy is recommended only to control hemostasis. Available evidence is not enough to justify the use of intracapsular techniques.

Perioperative management

No preoperative tests are usually carried out in healthy adults younger than 40 (class ASA I); coagulation tests are recommended in case familiar or individual anamnesis suggests a suspected coagulopathy.

Tonsillectomy and adenoidectomy are both carried out under general anesthesia.

Carrying out surgery in hospitals with a pediatric intensive care unit able to provide postoperative monitoring with pulse oximetry is recommended in children younger than 3 with OSAS, or in children with perioperative nadir $\text{SaO}_2 \leq 80\%$, or with comorbidities.

Perioperative antibiotics are useful to reduce postoperative morbidity, while paracetamol and dexamethasone are recommended to prevent postoperative pain and vomiting. NSAIDs are not indicated due to the higher risk of bleeding.

Clinical and organizational aspects of adenotonsillectomy

Tonsillectomy can be performed as a one-day surgery procedure, while adenoidectomy as a day surgery procedure with no overnight stay, if social requirements are met. Hospitals should have personnel able to provide intensive care 24 hours a day, and staff able to promptly detect complications.

Children should be hospitalized in structures with spaces answering the needs of their age. Subjects younger than 3 should be hospitalized in structures equipped with intensive care units able to assist children.

Pediatricians and general practitioners should be actively linked with the hospitals carrying out adenotonsillectomy to guarantee continuity of care.

Introduction

History

Tonsil (from *tonsa*, meaning “oar” in Latin) removal is an ancient practice.¹ Hindu medicine has been the first to describe a tonsillectomy in 1000 BC.² The techniques used for tonsil removal evolved in the following thirty centuries: from manual tonsil enucleation, described by Aulo Cornelio Celso in ancient Rome, to the first instruments introduced by Galeno; from the strangulation by thread used from XVI to XIX century, to the guillotine technique introduced around 1750. “Cold” dissection has been reported first on *The Lancet* in 1909,³ while cauterization techniques, already tested during the first decades of the century, returned to be popular during the Sixties with the surgical diathermy (electrosurgery). Instrumental “cold” dissection with continuous hemostasis is still considered the standard with which to compare the effectiveness, safety and cost of every new technique, even if several new “hot” techniques (radiofrequency, laser, harmonic scalpel, microdebrider) have been introduced to reduce postoperative morbidity and risk of haemorrhage.^{2,4}

Epidemiology

Adenotonsillectomy is long known to be characterized by a sensible geographical variability among nations⁵⁻⁸ and inside single countries.⁹⁻¹¹ These variations are usually ascribed more to the heterogeneity in clinical practice and in training of specialists, than to differences in morbidity.¹⁰

Tonsillectomy and adenoidectomy are still among the most frequently carried out interventions, though tonsil removal has become less frequent in Europe in the last decades.

In Italy a reduction, since 2003, in the number of tonsillectomies and a decrease in geographical variability of standardized tonsillectomy rates have been registered, following the implementation of the PNLG document.¹¹

The overall number of tonsillectomies has decreased from 59,916 in 2002 to 51,983 in 2003. In Italy tonsillectomy rates decreased from 10.7 in 2000 and from 10.5 in 2002, to 9.1 in 2003 and 9.4 in 2004. Adenoidectomy rates showed at the same time a progressive decrease (Fig. 1). The variability of standardized regional tonsillectomy rates showed a reduction between 200 and 2004 from 19 to 16.6 in Piedmont and from 3.5 to 4.2 in Basilicata (Fig 2, Tab 1). In this landscape the frequency of conditions causing tonsillectomy are also changing: in Italy from 2000 to 2004 the total amount of tonsillectomies decreased in terms of both absolute values (about 4,000 less surgeries) and relative values (from 44.7% to 43.6% out of total surgeries). Tonsillitis in 2004 caused 52% of tonsillectomies to be performed in North Italy and 22% to be performed in South Italy, where surgery for OSAS due to tonsil hypertrophy is increasing.¹²

The impact of the PNLG document in Italy is similar to the experiences made in Canada¹³ and in Vermont¹⁴ where a decrease of tonsillectomy rates was registered after the dissemination of clinical practice guidelines.

Updated studies on postoperative mortality after adenotonsillectomy are not available. The incidence reported in literature approximates the one reported for total anesthesia alone, with one death each 10,000-35,000 cases.¹⁵⁻¹⁶ In Italy, from 1999 to 2001, the mortality rate esteemed was up to one case among 95,000 surgeries.¹¹ The main causes are complications after anesthesia and postoperative hemorrhage.

Fig. 1 Tonsillectomy and adenoidectomy rates (per 10,000) in Italy. Years 1998-2004

Fig. 2 Standardized tonsillectomy rates with or without adenoidectomy per region and autonomous province. Italy, 2004

Tab 1 Standardized tonsillectomy rates with or without adenoidectomy per region and autonomous province. Comparison 200-2004

Guideline objective and audience

This document is aimed at providing updated evidence and clinical practice recommendations drawn out by a panel of experts, to promote the appropriateness and safety of adenotonsillectomy.

The guideline deals with the following issues:

- indications to tonsillectomy and/or adenoidectomy;
- effects and implications of the various surgical techniques;
- perioperative management;
- organizational strategies of adenotonsillectomy.

Suggestions included in the document refer to children and adults, if not otherwise specified, even though adenotonsillectomy is mainly carried out in children.

The document is addressed to all professionals (doctors, pediatricians, ENT specialists, orthodontists and anesthetists) treating adults and children with adenotonsillar pathologies in ambulatories and hospitals, and to citizens/patients and/or their parents. The citizen version is available in Italian on the following website: www.snlg-iss.it.

Methods

The PNLG document “The clinical and organizational appropriateness of tonsillectomy and adenoidectomy”, have been updated and integrated following the SNLG (National guideline system) methodology, thus becoming a guideline with graded recommendations.¹⁷

Work group

The multidisciplinary panel that drew up this document includes clinicians representing the main disciplines involved in the diagnosis and treatment of adenotonsillar diseases, and experts in guideline development methodologies and representatives of citizens’ associations.

National scientific associations took part in the guideline development process choosing their representatives.

The work group met several times in October 2006 and in January 2008 with the purpose of:

- identifying the new clinical questions, the keywords to build up the search strategy and the biomedical databases to be searched;
- discussing the summary of evidence and drawing up recommendations;
- drafting the guideline text.

Literature search

Searched databases

Cochrane Database of Systematic Review

ACP Journal Club

DARE

CCTR

PubMed

Embase through OVID

Cinahl

Emed

Biosis

British Nursing Index

Scisearch

Pascal

Time range:

1990 (new questions)/2002 (questions to be updated) – October 2007

Databases were searched using a specific search strategy for each new or updated question. All strategies are available on the website: www.snlg-iss.it.

The following main search filter was used appropriately combined through Boolean operators with the keywords and the terms defined for each question:

(Tonsillectomy OR tonsillotomy OR tonsil/surgery OR tonsillectomy OR adenoidectomy OR adenotonsillectomy)

Secondary documentation such as systematic reviews and guidelines, and specific types of studies for each question, were searched for each new or updated question.

Members of the panel suggested useful bibliography not gathered through the online searches. Suggested studies were included if considered relevant and if published during the same time range adopted for primary search.

The main guideline websites were searched to identify relevant documents. *Clinical Evidence* and books were also searched and are listed in the bibliography.

Documents and studies were selected in Italian, English, French, Spanish and German, when available.

Data mining, summary of evidence and formulation of recommendations

Two reviewers selected all documents and studies gathered through the database search. A further selection was carried out after obtaining the full text of those documents whose title and abstract did not make their relevance clear.

Specifically trained personnel selected studies, and carried out their methodological evaluation and the data mining process on each selected study, following the forms created by the Scottish Intercollegiate Guidelines Network (SIGN), each specific for a type of study.

Evidence gathered from each single study has been consequently summarized in one specific table for each question and study design.

The work group drew up recommendations on the basis of available evidence or, if not available, following principles of good clinical practice (GCP) suggested by experts.¹⁷⁻¹⁸

The grading method described in the PNLG Methodological Handbook¹⁷ was used, including six levels of evidence (I-VI) and five strength of recommendation grades (A-E). The grading system implies that the decision of recommending a procedure depends on:

- quality of scientific evidence;
- healthcare burden;
- costs;
- acceptability;
- feasibility of surgery.

External review

The document defined by the work group was sent to external experts, explicitly requiring them to evaluate its accuracy and readability, and the clinical relevance and feasibility of recommendations. The referee group was made of three ENT specialists, two pediatricians, one health manager and one expert in guideline methodology.

Dissemination and implementation, monitoring, evaluation and update

Combined interventions for active dissemination and implementation will be carried out and monitored, as was previously done for the PNLG document:

promotion of the initiative on media and print;

- mail deliveries to Regional health authorities, health agencies, hospitals, doctors and opinion leaders;
- publications on websites (PNLG, Laziosanità-ASP, scientific societies, health agencies);
- scientific articles;
- interactive training courses with clinicians;
- presentations during national and international conferences;
- adaptation of the guideline to local contexts through the creation of integrated clinical pathways, focusing on overcoming implementation barriers.

Some of the audit indicators listed below can be used to monitor the local guideline implementation at district and hospital level:

- proportion of adenotonsillectomies due to OSAS after pulse oximetry;

- proportion of adenotonsillectomies due to OSAS after polysomnography;
- proportion of patients who underwent tonsillectomy due to OSAS, but not adenoidectomy;
- proportion of tonsillectomies performed using “cold” dissection with or without bipolar diathermy for hemostasis;
- proportion of tonsillectomies performed using monopolar diathermy;
- proportion of tonsillectomies performed using coblation;
- proportion of tonsillectomies performed using harmonic scalpel;
- proportion of tonsillectomies performed using intracapsular technique;
- proportion of tonsillectomies complicated by (primary and/or secondary) hemorrhage;
- proportion of tonsillectomies complicated by vomit;
- proportion of tonsillectomies complicated by dehydration;
- proportion of tonsillectomy patients who were administered perioperative dexamethasone;
- proportion of tonsillectomy patients who were administered perioperative antibiotics;
- proportion of patients tonsillectomy who were administered NSAIDs to prevent or control postoperative pain;
- proportion of children younger than 3 hospitalized (acute) in structures not equipped with an intensive care unit able to assist children;
- proportion of patients younger than 3 hospitalized (acute);
- proportion of tonsillectomy patients (children) without comorbidity, who underwent preoperative thoracic radiography.

Rough and standardized tonsillectomy rates at national and regional level will be estimated, to assess the impact of the guideline, defining their geographical and temporal variability, on the basis of hospital discharge data provided by the Ministry of Health.

Annexes and availability of full text

The full-text guideline in Italian and English and the citizen version in Italian are available on the website: www.snlg-iss.it.

Indications to tonsillectomy and/or adenoidectomy

Obstructive sleep apnea due to adenotonsillar hypertrophy in children

Obstructive sleep apnea (OSAS) is a sleep respiratory disorder interrupting breathing during sleep and is due to a prolonged partial obstruction (hypopnea) and/or an intermittent complete obstruction (apnea) altering ventilation, respiratory gas exchanges and sleep structure. Sleep respiratory disorders are classified in a wide range of severity, including primary snoring, upper respiratory tract high-resistance syndrome (with OSAS symptoms and negative to diagnostic tests) and OSAS.¹⁹

OSAS prevalence in children is estimated around 2%.²⁰ Clinical manifestations include: habitual snoring, oral breathing, daytime sleepiness, nocturnal enuresis, neurocognitive and behavioral disorders, school and learning problems, cardiovascular consequences and delayed growth.

Diagnosis of OSAS

Several cohort studies suggest that anamnesis and objective examination are useful in diagnosing sleep respiratory disorders.²¹⁻²⁸ (Level of evidence III)

A systematic review including studies of different design,²⁹ and a guideline on the diagnosis of OSAS in children³⁰ report that the clinical assessment has strong sensitivity and low specificity in diagnosing OSAS, if compared with nocturnal polysomnography (PSG). (Level of evidence III)

The assessment of tonsil size is carried out on the basis of graded scales (Fig. 3).^{19, 31}

Nocturnal pulse oximetry is a good first diagnostic test for sleep respiratory disorders and OSAS, due to its high positive predictive value (97%), ease of performance and low cost.³²⁻³³ (Level of evidence III)

A positive test, with 3 or more desaturation clusters and at least 3 desaturations lower than 90%, is an adequate basis on which to diagnose OSAS.³² Desaturation is defined, according to Brouillette, as the decrease of $SaO_2 \geq 4\%$, while cluster means 5 or more desaturations in a period of 10-30 minutes.

Nocturnal PSG allows to measure several cardiac, respiratory and neurological functional parameters, and body movements. It is considered the gold standard for the diagnosis of sleep respiratory disorders and to assess OSAS severity.³⁴⁻³⁵ (Level of evidence III)

Fig. 3 Grade of tonsil hypertrophy³¹

0 (not visible)	Tonsils do not reach tonsil pillars
1+ (< 25%)	Tonsils fill less than 25% of the transversal oropharyngeal space measured between the anterior tonsil pillars
2+ (< 50% > 25%)	Tonsils fill less than 50% of the transversal oropharyngeal space
3+ (< 50% > 75%)	Tonsils fill less than 75% of the transversal oropharyngeal space
4+ (> 75%)	Tonsils fill 75% or more than the transversal oropharyngeal space

The use of a nasal cannula as a flow sensor³⁷⁻³⁹ and of the plethysmography for the detection of thoraco-abdominal excursions⁴⁰⁻⁴² allows a more accurate assessment of hypopneas, limitations of flow and counterphase³⁶. (Level of evidence III)

The Apnea-Hypopnea Index (AHI, or respiratory disorder index) is the number of obstructive events per sleep hour and is the most widely used polysomnographic measure: in children a value < 1 is considered non-physiological, while a value > 5 is considered definitely pathological.³⁰ PSG results do not always correspond to severity of symptoms, thus requiring an integration of such results with a clinical-anamnestic assessment.³⁰ (Level of evidence VI)

PSG has also technical and organizational difficulties. An abbreviated home PSG can be an alternative.⁴³⁻⁴⁴ (Level of evidence III)

Transnasal rhino-pharyngeal fiberoendoscopy is the best technique to assess the grade of adenoid hypertrophy; palpation is on the contrary scarcely reliable; mirror examination underestimates choane obstruction and lateral neck radiography findings do not show correlations with symptoms.⁴⁵⁻⁴⁷ (Level of evidence III)

Fiberendoscopy allows also to assess the risk of pharyngeal collapse, the obstruction of upper tonsillar pole due to hypertrophy and the presence of effusion. (Level of evidence VI)

Recommendations

GCP Children with suspected sleep respiratory disorders should be assessed with a diagnostic approach integrating clinical and instrumental tests.

III/A Medical history assessment (focusing in particular on snoring, respiratory pauses during sleep, daytime sleepiness and hyperactivity, school and behavioral problems, respiratory tract infections) should be accurately carried out, using, if necessary, specific questionnaires.

III/A Comorbidities able to contribute to OSAS (obesity, recurrent upper respiratory tract infections, nasal obstruction, orthodontic or craniofacial anomalies, macroglossia, neuromuscular diseases) should be detected using multidisciplinary approach, for the diagnostic assessment, even if in presence of a low-grade tonsil hypertrophy.

III/A Nocturnal home pulse oximetry is recommended as initial test to diagnose sleep respiratory disorders in children, and it should be analyzed with plethysmographic (and eventually actigraphic) curve to identify artifacts.

VI/B 3-6 months of watchful waiting are suggested in case of negative nocturnal pulse oximetry and persistence of symptoms, after which a re-assessment is carried out repeating pulse oximetry.

III/B Polysomnography should be carried out only when pulse oximetry results are not conclusive in agreement with Brouillette criteria.

III/B Carrying out polysomnography using nasal cannula to assess flow and plethysmography to detect thoraco-abdominal excursion is preferable for a more accurate detection of hypopnea episodes.

III/B Reduced polysomnography, even domiciliary, can be considered a good diagnostic alternative to polysomnography.

III/A Rhino-pharyngeal fiberendoscopy is the gold standard in children of all ages to assess rhino-pharyngeal patency and functionality.

III/D Lateral neck radiography is not recommended to assess adenoidal hypertrophy due its lack of diagnostic accuracy and the radiological risk for children.

Effects of tonsillectomy and/or adenoidectomy and impact on quality of life

Available evidence on the effectiveness of adenotonsillectomy in children with OSAS comes from observational studies,⁴⁸ considered the difficulty of carrying out randomized controlled studies due also to ethical issues.

Available studies agree on the effectiveness of this treatment in children with OSAS due to adenotonsillar hypertrophy and no significant comorbidity. A systematic review based on 14 case-series⁴⁹ and two before-after case studies⁵⁰⁻⁵¹ indicate that adenotonsillectomy normalizes polysomnographic parameters (AHI and desaturation O₂). (Level of evidence III)

Brietzke's metanalysis showed a 83% rate of children successfully treated.

Other before-after prospective studies indicate that OSAS causes a cognitive/behavioral impairment and affects children's quality of life, and that surgery is effective in resolving sleep disorders^{50,52-54} improving voice alterations,⁵⁵ cognitive/behavioral impairments^{54,56-58} and quality of life,^{51-52,56,59-60} with durable results.⁶¹⁻⁶² (Level of evidence III) Children who underwent only adenoidectomy as a treatment for OSAS are at high risk of undergoing later on tonsillectomy due to a persistence of pathological conditions.⁶³⁻⁶⁵ (Level of evidence III)

The *American Academy of Pediatrics* guideline³⁵ suggests the use of Continuous Positive Airway Pressure (CPAP) only in subjects who cannot undergo surgery or whose conditions do not improve with surgery.

Recommendations

III/A Adenotonsillectomy is the recommended treatment in children with OSAS due to adenotonsillar hypertrophy.

III/A Simple adenoidectomy is not recommended, considered the high risk of re-intervention due to OSAS persistence.

III/A Adenotonsillectomy should be carried out quite promptly in children with OSAS and functionally significant tonsil hypertrophy, considered the cognitive/behavioral impairment this syndrome causes in children, thus affecting school performances and quality of life.

VI/A Severe cases, identified on a clinical and/or instrumental basis, should undergo surgery as soon as possible.

V/A A clinical (and instrumental, in severe cases) re-assessment should be carried out in children after adenotonsillectomy to assess either full recovery or the need of further treatments.

VI/B The treatment of the concomitant condition and the assessment of the severity of adenotonsillar obstruction is recommended, if possible, in case of significant co-morbidity (obesity, recurrent upper respiratory tract infections, nasal obstruction, orthodontic or craniofacial anomalies, macroglossia, neuromuscular diseases) before considering adenotonsillectomy.

Orthodontic treatments and treatments with nasal steroids

A systematic review,⁶⁶ carried out to assess the effectiveness of functional oral and orthopedic devices in children with OSAS, found only one randomized controlled trial^{66bis} reporting a significant reduction of AHI values and respiratory symptoms in children with malocclusion and tonsil hypertrophy grade > 2 treated with these devices (n = 32; 28% non-differential losses at follow-up). (Level of evidence II)

Two small cohort studies assessing the impact of rapid mandibular expansion devices in children with OSAS⁶⁷ and rapid palate expansion devices in children with ogival palate, oral breathing and adenotonsillar hypertrophy,⁶⁸ reported respectively an improvement of polysomnographic parameters and an increasing of retropharyngeal space. (Level of evidence III)

Three randomized controlled trials indicate the administration of nasal steroids to children with OSAS and adenotonsillar hypertrophy⁶⁸⁻⁷⁰ or with adenoidal hypertrophy⁷¹ is useful in improving polysomnographic parameters and obstructive symptoms⁷¹ and in reducing adenotonsillectomy frequency to 2 years.⁶⁹⁻⁷⁰ (Level of evidence II)

Recommendations

II/B Children with OSAS and tonsil hypertrophy, having suspected occlusal anomalies or other craniofacial anomalies need orthodontic assessment before adenotonsillectomy.

VI/B Orthodontic interventions should be considered as a therapeutic option before or contextually to treatment with CPAP.

II/B Nasal steroids can be useful in reducing severe conditions in children with adenotonsillar hypertrophy and nasal obstruction waiting for surgery, even if they do not represent a conclusive treatment for OSAS.

Recurrent tonsillitis

The most common etiological agents of recurrent tonsillitis are bacteria, such as Group A *Streptococcus beta-emoliticus*, *Stafilococcus aureus*, *Klebsiella pneumoniae* and *Haemophilus influenzae*.⁷²⁻⁷³

Chronicisation of tonsil and adenoidal infections can be caused by:

- bacterial biofilms, a complex group of bacteria attached to mucosa, capable of surviving to the immune system and of resisting to antibiotics;⁷⁴
- “internalization” of Group A *Streptococcus beta-emoliticus*, that become capable of reaching into the tonsil mucosa cells, thus becoming less sensible to beta-lactam antibiotics;⁷⁵

- atypical pathogens (*Chlamydiae*, *Mycoplasmas*) and viruses, even if their role remains still uncertain.⁷⁶⁻⁷⁹

Recurrent tonsillitis was supposed to be supported by an interaction between viruses and bacteria through the reactivation of latent viruses (*Adenovirus* and *Epstein Barr virus*) with a depression of tonsil immune response.⁸⁰

The original criteria for the definition of severe tonsil infections, on which basis to establish the indications to tonsillectomy, are those proposed by Paradise in 1984.⁸¹ Later on, the guideline drawn out by SIGN in 1999 defined more updated recommendations,⁸² that have been adopted in the PNLG document.

These criteria can be applied to the overall clinical conditions of patients with complications or comorbidity.⁸³

Effects of tonsillectomy

Clinical Evidence's systematic review⁷⁸ reports, on the basis of the few available studies, that defining if tonsillectomy reduces symptoms in children with severe recurrent tonsillitis, when compared with antibiotics, is not possible. Moreover, benefits from tonsillectomy could fail to balance the morbidity associated to surgery in children with non-severe tonsillitis. No studies are available allowing to define if tonsillectomy determines a real benefit in adults with tonsillitis.⁷⁸

The three randomized studies carried out by van Staaij's group indicate that adenotonsillectomy in children with mild to moderate symptoms due to pharyngo-tonsillitis or with tonsil hypertrophy not associated with OSAS, do not, after six months, determine more benefits than watchful waiting.⁸⁴ Adenotonsillectomy implies also higher costs (50%),⁸⁵ even if it reduces the prevalence of oropharyngeal microbial flora.⁸⁶ (Level of evidence II)

Alho's randomized controlled study⁸⁷ (subsequent to the *Clinical Evidence's* review)⁷⁸ shows that adults who underwent tonsillectomy due to recurrent streptococcal pharyngitis suffer less pharyngitis episodes than those who do not undergo surgery during the three months after surgery. (Level of evidence II) This evidence substantially confirms data reported in the PNLG document on the basis of the Burton's Cochrane review,⁸⁸ of the three Paradise's trials,^{81,89-90} and of the SIGN guideline.⁸²

Recommendations

II/A The indications to tonsillectomy should, on the basis of available evidence and considering recurrent tonsillitis tend to improve with time, be limited only to both children and adults with recurrent tonsillitis of proven severity meeting all of the following criteria:

- five or more episodes of tonsillitis per year;
- episodes disabling and impairing normal activities;
- symptoms lasting for a minimum of one year.

At least six-month of watchful waiting are recommended to assess the pattern of symptoms, using a clinical diary.

In less severe cases, not meeting the cited criteria and responding to antibiotics, a watchful waiting is recommended, while surgery is not indicated.

VI/B Cited criteria should be used less strictly in presence of:

- significant laterocervical adenopathy (> 2 cm) due to recurrent tonsillitis and persisting after administration of antibiotics;
- one or more episodes of peritonsillar abscess;
- febrile convulsions;
- deformities of respiratory tract or of cardio circulatory system, or other severe pathologies.

IV/B Adenoidectomy associated with tonsillectomy should be carried out only if clinical indication justifying combined surgery are present.

Peritonsillar abscess

Peritonsillar abscess is the most frequent complication of acute tonsillitis. It is an accumulation of pus in the space between tonsil capsule and the superior pharyngeal constrictor muscle, that can itself be involved in the infection. Abscesses affect mainly adolescents and young adults.⁹¹ Trismus, sensible dysphagia and respiratory difficulties can complicate the clinical situation.

Effects of treatment

A systematic review of heterogeneous studies,⁹² including also the studies included in the PNLG 2003 document, indicates that the various surgical options (aspiration, incision and drainage, immediate or delayed tonsillectomy) are substantially equally effective. (Level of evidence I)

A case study⁹³ reports in children a good response to conservative treatments with intravenous antibiotics. (Level of evidence V)

Three case studies⁹⁴⁻⁹⁶ showed that carrying out tonsillectomy in patients with peritonsillar abscess implies a higher risk of postoperative hemorrhage. (Level of evidence V)

Recommendations

I/A Peritonsillar abscess in children and adults should be treated with systemic antibiotics and through incision and drainage of the abscess on the basis of clinical conditions.

VI/A A thorough clinical observation along with hospitalization is recommended in case of complications to control airways patency.

VI/B Tonsillectomy can be delayed after the end of acute phase, if relapses are present or on the basis of cited criteria for recurrent tonsillitis.

PFAPA syndrome

The acronym PFAPA (*Periodic Fever, Aphthous stomatitis, Pharyngitis and cervical Adenitis*) refers to the syndrome characterized by episodes of high fever lasting for 3 to 6 days and recurring each 3-8 weeks, associated with one of the following symptoms: aphthous stomatitis, pharyngitis and cervical adenitis. This syndrome can be diagnosed by exclusion in children younger than 5.⁹⁷

Effects of tonsillectomy

In a systematic review of six retrospective studies⁹⁸ including a total of 44 children, tonsillectomy was found to cure PFAPA syndrome in 77% of cases. A randomized controlled trial on 26 young patients, including a 12 months follow-up, shows that tonsillectomy is far more effective in healing PFAPA than no surgery.⁹⁹ (Level of evidence II)

The systematic review indicates also that the syndrome often resolves spontaneously and that steroids reduce, even dramatically, the length of febrile episodes without modifying the syndrome's natural history.⁹⁸ (Level of evidence V)

Recommendations

II-V/D The routine use of tonsillectomy for the treatment of children with PFAPA syndrome is not recommended, due to the weakness of available evidence, and the tendency of this syndrome to resolve spontaneously.

VI/B The effect of tonsillectomy in rare cases of very frequent and close febrile episodes due to PFAPA syndrome associated with unfavorable course, is almost always conclusive.

Recurrent acute otitis media and chronic otitis media with effusion

Recurrent acute otitis media should be distinguished, among middle ear infections, from chronic otitis media with effusion. The last one is characterized by the presence in middle ear of serum or mucus, but not of purulent mucus ("glue ear"). Children can suffer from mild hearing loss and speech difficulties. Chronic otitis media, differently from acute otitis media, is not associated to pain, fever and general malaise.¹⁰⁰

Recurrent acute otitis media is characterized by the occurrence within six months of two or three episodes of acute otitis media with local and general symptoms or of four or more episodes within one year.¹⁰¹

Factors determining a higher risk of recurrence are: inadequate treatment of acute otitis media, passive smoke exposure, diabetes mellitus, immune deficiencies, chronic rhino-sinusitis, cystic fibrosis and allergy.¹⁰²

Effects of adenoidectomy and of tympanostomy (ventilation) tubes

Lous's Cochrane review¹⁰³ with a meta-analysis of 21 randomized controlled trials, concludes that the insertion of ventilation tubes associated or not associated with adenoidectomy is moderately effective in children with otitis media with effusion. (Level of evidence I)

Benefits and damages related to the insertion of ventilation tubes associated or not associated to adenoidectomy tend to be balanced, considered the improvement of hearing is only temporary, that cognitive and speech abilities are not affected, and that the risk of tympanosclerosis is increased¹⁰⁰ (Level of evidence I)

Paradise's randomized controlled trials¹⁰⁴⁻¹⁰⁵ show that the immediate insertion of ventilation tubes in children younger than 3 do not help improving cognitive development after 6-10 years, if compared with delayed insertion (after six months in case of bilateral effusion and after nine months in case of unilateral effusion). (Level of evidence II)

*Clinical Evidence*¹⁰⁰ reports that the effectiveness of adenoidectomy alone is not known, while the *American Academy of Pediatrics* guideline¹⁰⁶ recommends not to carry out adenoidectomy as a first procedure for the treatment of otitis media with effusion, except in case of specific indications (nasal obstruction, chronic adenoiditis). (Level of evidence VI)

A randomized controlled trial¹⁰⁷ concludes that adenoidectomy, facilitating the insertion of ventilation tubes, reduces the recurrence of chronic otitis with effusion and recurrent acute otitis media only in case adenoidal hypertrophy caused rhino-pharyngeal obstruction. (Level of evidence II)

Autoinflation with specific nasal balloons reduces for a short time the entity of effusion, but its long-term effects are not known.¹⁰⁰

The PNLG document reported that adenoidectomy reduces the recurrence of acute otitis media in children after the insertion of ventilation tubes.^{101,108}

Two more recent randomized controlled trials¹⁰⁹⁻¹¹⁰ indicate that adenoidectomy associated to the insertion of ventilation tubes, does not reduce the episodes of recurrent acute otitis media in children younger than 4. Another randomized controlled trial¹¹¹ indicates that adenoidectomy is not effective as a first surgical treatment to prevent the recurrence of acute otitis media. (Level of evidence II)

*Clinical Evidence*¹¹² does not take into consideration adenoidectomy as a therapeutic option for recurrent acute otitis media. It indicates also that the insertion of ventilation tubes reduces recurrences in the short term, but increases the risk of complications such as tympanosclerosis, atrophy, retraction and chronic perforation of the eardrum membrane. (Level of evidence II)

Recommendations

I/B Performing adenoidectomy as the first-choice intervention for the treatment of chronic otitis media with effusion is not recommended; it should be carried out only in patients with chronic adenoiditis (recurrent inflammation resistant to medical treatments) or with adenoids obstructing the tubaric orifice.

II/B A period of watchful waiting of at least six months is recommended before inserting tympanostomy (ventilation) tubes for the treatment of otitis media with effusion.

VI/E Tonsillectomy should not be performed as a treatment of otitis media with effusion.

II/B The effectiveness of adenoidectomy as a treatment for recurrent otitis media, associated or not associated to the insertion of ventilation tubes, is uncertain, therefore this treatment is recommended only in patients with adenoid hypertrophy obstructing the tubaric orifice.

Recurrent or chronic rhino-sinusitis

Chronic rhinosinusitis is a nose and paranasal sinuses infection characterized by symptoms, such as nasal congestion, nasal effusion, facial tension and pain, and hyposmia or anosmia, lasting for 12 weeks.¹¹³ Bacterial biofilms attached to the adenoids could act as infection reservoir.

Effects of adenoidectomy

Poor evidence from a prospective study¹¹⁴ and a case study,¹¹⁵ shows that adenoidectomy is effective in reducing chronic rhino-sinusitis symptoms in children. (Level of evidence III)

A case study showed the effectiveness of intravenous antibiotics, eventually associated with adenoidectomy, in the treatment of chronic rhino-sinusitis in children.¹¹⁶ (Level of evidence V)

In a non-randomized prospective study, endoscopic sinuses surgery resulted more effective than adenoidectomy in the treatment of chronic rhino-sinusitis resistant to antibiotics, decongestants and antiallergic agents administered for at least six months.¹¹⁷ (Level of evidence III)

Another case study on children¹¹⁸ shows that intravenous antibiotics associated to adenoidectomy and aspiration/irrigation of sinuses is effective in the treatment of chronic rhinosinusitis in a high percentage of cases. (Level of evidence V)

Recommendations

V/B The first-choice treatment for recurrent or chronic rhinosinusitis in children and adults is administration of the right dosage of antibiotics for an adequate period of time.

III/B Endoscopic sinuses surgery and/or adenoidectomy are indicated in those cases not resolving after antibiotic treatment and after searching and curing all concomitant pathologies, such as allergy and gastroesophageal reflux.

Surgical techniques

The traditional “cold” dissection technique for tonsillectomy has been first described about a hundred years ago.³ The use of this technique implies the removal of tonsils dissecting the peritonsillar space between the tonsil capsule and the muscular wall, vases are afterwards tied for hemostasis.¹¹⁹ Several techniques have been introduced since then, with the purpose of reducing length of surgery, intraoperative bleeding and postoperative morbidity. “Hot” techniques, allowing to contemporaneously remove tonsils and control hemostasis, include:

- diathermy;
- radiofrequency, in which the heat is produced by electromagnetic radiations (coblation, *ligasure*);
- harmonic ultrasound scalpel (*ultracision*);
- argon plasma coagulation;
- other types of laser.

The heat produced by these techniques allows hemostasis, but can cause a thermal damage to adjacent tissues.⁴ Diathermy is commonly used for hemostasis after “cold” tonsillectomy.

The partial removal of tonsil tissue (tonsillotomy) using intracapsular techniques (bipolar diathermy, radiofrequency, microdebrider, low-temperature plasma) has recently been re-proposed as an alternative to bilateral tonsillectomy.

Adenoidectomy is carried out via the mouth by curettage, diathermy with a suction, radiofrequency techniques, and via the nose through endoscopy.

Dissection versus diathermy

Strong evidence from a systematic review of heterogeneous studies,¹²⁰ from the English *National Prospective Tonsillectomy Audit* (NPTA) registry,^{4,121-122} one randomized controlled trial,¹²³ and large prospective cohort studies¹²⁴⁻¹²⁶ shows that the risk of postoperative hemorrhage is higher after tonsillectomy carried out with “hot” techniques than after tonsillectomy carried out with “cold” dissection. (Level of evidence I)

Mowatt’s systematic review¹²⁰ and NPTA’s results¹²¹ indicate that monopolar diathermy causes a risk of postoperative hemorrhage 4-5 times higher than “cold” dissection. (Level of evidence I/III)

The same studies show that bipolar diathermy causes a risk of hemorrhage 2 to 3 times higher than “cold” dissection. Contrasting evidence exists in relation to “dose-response” effects after the use of bipolar diathermy: NPTA⁴ indicates that the risk of hemorrhage is twice higher if this technique is used only for hemostasis and three times higher if it is used also for dissection. Mowatt’s review¹²⁰ shows instead a higher risk of hemorrhage if bipolar diathermy is used only for hemostasis than if it is used for both dissection and hemostasis.

Two more systematic reviews¹²⁷⁻¹²⁸ and a randomized controlled trial¹²⁹ show that diathermy reduces duration of surgery and intraoperative bleeding, but causes the increasing of postoperative pain, if compared with “cold” dissection. (Level of evidence I)

NPTA⁴ and a cohort study¹³⁰ indicate that the risk of hemorrhage is higher in adults than in children, and in patients treated by less expert surgeons. (Level of evidence III)

Coblation

Two systematic reviews^{120,131} and two observational studies¹³²⁻¹³³ show a higher risk of secondary hemorrhage (OR 3.75; IC 95% 1.29-12.12)¹²⁰ and of re-operation after tonsillectomy carried out with coblation than after “cold” dissection. (Level of evidence I)

No adequate evidence exists to determine whether coblation is superior to the other surgical techniques in terms of intraoperative bleeding, duration of surgery, postoperative pain and return to normal activities and diet.^{131,134-135}

Harmonic ultrasound scalpel (*ultracision*)

Tonsillectomy carried out with harmonic scalpel implies a reduction of intraoperative bleeding, if compared with traditional techniques.¹³⁶ (Level of evidence II)

Results are contrasting in relation to duration of surgery,¹³⁸⁻¹³⁹ risk of hemorrhage,¹³⁷⁻¹³⁹ postoperative pain^{136-137, 139-141} and return to normal diet.^{136, 140-141}

Tonsillectomy with harmonic scalpel implies 30-50% more expenses, if compared with diathermy and “cold” dissection.¹⁴²⁻¹⁴³

Other surgical techniques

Currently available evidence is not enough to prove the effectiveness and safety of tonsillectomy carried out with argon plasma coagulation,¹⁴⁴ *ligasure* (or *thermal welding*),¹⁴⁵⁻¹⁴⁶ KTP or diode laser.¹⁴⁷⁻¹⁴⁸

Intracapsular techniques

Available evidence – from heterogeneous randomized trials considering various techniques (radiofrequency,¹⁴⁹⁻¹⁵² microdebrider,¹⁵³⁻¹⁵⁵ low-temperature plasma,¹⁵⁶ bipolar diathermy¹⁵⁷), different outcomes, length of follow-up and type of techniques used as a control – mostly shows that intracapsular tonsillectomy implies a lower postoperative morbidity in terms of pain,¹⁵³⁻¹⁵⁴ use of antiemetics,¹⁵³ return to normal activity¹⁵³ and normal diet.¹⁵⁵ (Level of evidence II)

However, this technique is associated to a higher risk of tonsil remnant or regrowth.^{151,153,156,158}

A large case study reports a significantly lower incidence of secondary hemorrhage after intracapsular tonsillectomy carried out with microdebrider and diathermy for hemostasis, than after traditional tonsillectomy carried out mainly with monopolar diathermy (1.1% vs 3.4%).¹⁵⁹ (Level of evidence V)

Adenoidectomy

Available evidence is not enough to show differences between the various currently available adenoidectomy techniques (curette, diathermy with a suction, radiofrequency, endoscopic) in terms of cost-effectiveness and safety.¹⁶⁰⁻¹⁶³ (Level of evidence II/V)

Recommendations

I/A The use of “cold” dissection techniques is recommended, reserving bipolar diathermy only to hemostasis, due to the higher risk of hemorrhage and pain after tonsillectomy carried out with diathermy.

III/B Bipolar diathermy for hemostasis should be used sparingly, carefully controlling power, frequency and length of use to avoid an excessive thermal damage to adjacent tissues.

I/E Monopolar diathermy should not be used for dissection nor for hemostasis, due to the very high risk of postoperative hemorrhage.

I/E Tonsillectomy should not be carried out with coblation, due to the higher risk of postoperative hemorrhage than in “cold” dissection and to the absence of benefits in terms of intraoperative bleeding and postoperative morbidity.

II/B Harmonic scalpel, using not electric but mechanic energy for dissection and hemostasis, can represent an alternative to “cold” dissection in selected cases, taking into account its similar effects and higher costs.

II/C Tonsillectomy carried out with argon plasma coagulation, *ligasure* (*thermal welding*) and laser is not recommended outside controlled clinical studies, due to the lack of evidence on the effectiveness and safety of these techniques and of their high costs.

V/C No evidence is available justifying the use of intracapsular techniques outside randomized clinical trials with an adequate follow up to assess the risk of relapse and reintervention.

II/B The proven effectiveness and safety of the various adenoidectomy techniques suggests they can be considered equally reliable.

VI/A A direct endoscopic check or an indirect check with optics to verify the complete removal of adenoidal tissue, and an accurate control of hemostasis is recommended.

Perioperative management

Preoperative tests

The *National Institute of Clinical Excellence's* guideline¹⁶⁴ and the Italian Regional Health Services Agency's guideline,¹⁶⁵ do not recommend, on the basis of expert opinion, any preoperative test before adenotonsillectomy in healthy children and adults younger than 40 (*ASA physical status I*, following the *American Society of Anesthesiologists'* classification). (Level of evidence VI)

In adults older than 40 tests should be prescribed in each case on the basis of age, ASA grade and type of organ comorbidity.

Four cohort studies¹⁶⁶⁻¹⁶⁹ show that the routine coagulation screening with PT and PTT does not predict the risk of bleeding after tonsillectomy, and its use should be reserved only to patients with a personal or familial history positive for coagulopathies. (Level of evidence III)

A diagnosis study,¹⁷⁰ shows that PTT test has an excellent sensitivity and a satisfying diagnostic specificity in identifying isolated von Willebrand factor deficiencies. (Level of evidence III)

Recommendations

VI/B No preoperative tests are prescribed in healthy children and adults younger than 40, grade ASA I.

III/B Preoperative coagulation screening should be carried out carrying out a thorough personal and familial anamnesis, limiting preoperative tests to hemoglobin dosage, PT, PTT and platelets count in subjects having a medical history unreliable or suggesting coagulopathies.

VI/D Acute phase reactants (ESR or CRP) and antistreptolysin titre are clinically useless in the preoperative phase.

BPC Anesthetists can choose, on the basis of clinical data, whether to carry out a preoperative ECG.

Anesthesiological techniques

Type of anesthesia

NPTA's final report indicates general anesthesia as the only option for tonsillectomy.⁴ No recent studies exist comparing general anesthesia with local anesthesia; a study dated 1990 indicates local anesthesia as an alternative to general anesthesia in collaborative adults and adolescents.¹⁷¹ The effects of postoperative administration of local anesthetics and other analgesic drugs on postoperative pain are treated in the paragraph: "Prophylaxis and treatment of postoperative pain and vomiting" (page ...)

Several randomized controlled trials show that completely intravenous anesthesia with propofol implies a less rapid recovering of consciousness,¹⁷² and that after inhaled anesthesia with sevoflurane/desflurane, patients wake up earlier but with agitation.¹⁷³⁻¹⁷⁴ Moreover, the time at which the patient wakes up after anesthesia do not affect the date of hospital discharge. (Level of evidence II)

Two prospective studies show that agitation in patients waking up after anesthesia with sevoflurane/desflurane can be prevented adding nitrogen protoxide in the inhaled mix and using opioid analgesics during surgery.¹⁷⁶⁻¹⁷⁷ (Level of evidence III)

The use of opioids, however, causes nausea and vomiting and sometimes also depression and respiratory failure in patients with severe obstructive apnea syndrome.¹⁷⁸⁻¹⁷⁹ (Level of evidence II)

Other non-opioid analgesics, in particular paracetamol, are equally effective in the perioperative prophylaxis of pain.¹⁸⁰⁻¹⁸³ (Level of evidence II)

Recommendations

VI/A General anesthesia is recommended to carry out tonsillectomy and adenoidectomy in children and adults, as it is safer in terms of airway control.

BPC Anesthetists can choose the most appropriate combination of anesthetics/analgesics after assessing all clinical, instrumental and laboratory parameters.

I/A Other analgesics, in particular paracetamol, are more effective in preventing pain and reducing the risk of postoperative complications and morbidity than opioids, even if the use of a balanced inhaled anesthesia associated to administration of intravenous opioids can prevent agitation in patients waking up.

Tracheal intubation or laryngeal mask

Laryngeal mask is a device to be located in the hypo-pharynx, it allows to establish a direct connection with patients' airway. The device is made of a conic section surrounded by an inflatable margin (the mask) and by a tube distally connected with its summit which is adapted to the airway. Laryngeal mask is safer than facial mask and can be used as an alternative to tracheal intubation.

Two randomized trials show that the use of laryngeal mask stress patients less than tracheal intubation.¹⁸⁴⁻¹⁸⁵ (Level of evidence II)

This technique, however, limits the space needed for surgery and may affect surgeons' actions.¹⁸⁵ Moreover, in 4% to 11% of patients¹⁸⁴⁻¹⁸⁶ laryngeal mask had to be replaced with a tracheal tube during surgery.

Recommendations

II/B Tracheal intubation is to be preferred to laryngeal mask both in adults and in children, as it is safer and allows more surgical accessibility.

Spontaneous or controlled ventilation

Pulmonary ventilation during surgery can be either spontaneous or mechanically or manually controlled.

A randomized study in patients aged 3-16 showed that spontaneous pulmonary ventilation implies an inappropriate exchange of respiratory gas and hemodynamic instability,¹⁸⁷ if compared with controlled ventilation. (Level of evidence II)

Controlled ventilation requires myorelaxation, usually obtained with curarizing agents. A randomized study shows that curarization in children younger than 3 is necessary as it facilitates tracheal intubation,¹⁸⁸ while other studies show that intubation can be easily carried out both in children¹⁸⁸⁻¹⁹⁴ and in adults¹⁹⁵ even without the support of myorelaxants. Moreover myorelaxants should not be administered in case of a difficult intubation.¹⁹⁶⁻¹⁹⁷

Recommendations

I/A Controlled pulmonary ventilation provides more guarantees of safety for patients, both adults and children, in terms of gas exchanges and hemodynamic stability.

I/B Intubation under anesthesia with sevoflurane is a satisfying alternative to intubation with myorelaxants (for example if compared to the standard combination propofol/ succinylcholine), considering the relatively short length of surgery and the opportunity of avoiding a long lasting myorelaxation.

I/A Intubation without myorelaxants can be easily carried out if intravenous anesthesia is used, administering various combinations of propofol/remifentanyl, propofol/alfentanil, propofol/fentanyl.

Postoperative monitoring in children with OSAS

A controlled clinical study,¹⁹⁸ a prospective study¹⁹⁹ and two retrospective studies on registries²⁰⁰⁻²⁰¹ show that OSAS severity in children is a risk factor for respiratory complications (O₂ desaturation and obstructive events) after tonsillectomy. (Level of evidence II/V)

O₂ desaturation with nadir < 80% detected through pulse oximetry and/or with an AHI of 5 or more episodes/hour detected through PSG, increase at least five times the risk of postoperative respiratory complications.²⁰⁰⁻²⁰¹ (Level of evidence V)

The risk is even higher in children younger than 2¹⁹⁹⁻²⁰⁰ and affected by associated pathologies such as asthma.^{200,202} (Level of evidence V)

Children with OSAS, during anesthesia, are particularly sensible to respiratory depression due to opioids, such as fentanyl,¹⁷⁸ and are much more sensible to the analgesic effect of opioids after surgery.²⁰²⁻²⁰³ (Level of evidence V)

The American Academy of Pediatrics' guideline³⁵ indicates the following characteristics as risk factors for postoperative complications in children with OSAS undergoing adenotonsillectomy: age < 3 years, severe OSAS or OSAS associated to cardiac or growth complications, obesity and recent respiratory infection, craniofacial anomalies and neuromuscular disorders. Moreover, a poor evidence shows that carrying out surgery in antemeridian hours reduces the risk of desaturation in children with OSAS.²⁰⁴ (Level of evidence V)

Recommendations

V/A The pulsoximetric monitoring with alarm is recommended until the morning after adenotonsillectomy in children with OSAS associated to:

- age < 3 years
- postoperative nadir SaO₂ ≤ 80%;
- comorbidities such as asthma, obesity, Down syndrome, craniofacial anomalies including retro or micrognathia and neuromuscular disturbs.

VI/A Children with OSAS associated with the cited characteristics should be hospitalized and undergo surgery in hospitals equipped with an intensive care unit able to assist children.

V/B Surgery should be carried out during antemeridian hours.

Perioperative use of antibiotics

A systematic review²⁰⁵ and two metanalysis²⁰⁶⁻²⁰⁷ show that antibiotics, included ampicillin, amoxicillin associated or non-associated with clavulonic acid, cefonicid and ticarcillin, reduce fever and halitosis that can occur after tonsillectomy, if administered immediately before surgery and/or for 5-7 days after surgery, and help patients returning to their normal diet and activities. (Level of evidence I)

Antibiotics seem not to improve other manifestations of postoperative morbidity, such as pain, nausea, vomiting. They do not reduce the risk of secondary hemorrhage, and can increase the risk of adverse events (rash and oropharyngeal candidiasis).

No evidence on the type of antibiotic to be chosen and on the optimal administration is available, due to the heterogeneity of the studies included in systematic reviews.

The results of a Cochrane systematic review will be available in 2008. The review was aimed at determining if perioperative administration of antibiotics reduces pain and the risk of hemorrhage after tonsillectomy.²⁰⁸

Recommendations

I/B Perioperative use of antibiotics is recommended to reduce some manifestations of postoperative morbidity (fever and halitosis) and to reduce the time needed to recover and return to normal diet after tonsillectomy.

VI/B Short-term administration of a therapeutic dosage of amoxicillin associated on non-associated to clavulonic acid or of other antibiotics with similar spectrum and cost (macrolides in case of penicillin allergy), is recommended at the time of surgery.

Prophylaxis of bleeding

Hemorrhage is the most worrying complication after tonsillectomy. Primary hemorrhage takes place within 24 hours after surgery, while secondary hemorrhage within two weeks, and more often between the 5th and the 10th day after surgery.

NPTA¹²¹ and some observational studies²⁰⁹⁻²¹¹ indicate that the incidence of post-tonsillectomy hemorrhage depends on the surgical technique used, on age and on gender. An overall incidence up to 3.5% (on 33,921 patients: 0.6% primary hemorrhage; 2.9% secondary hemorrhage; 0.9% undergoing new surgery to control hemorrhage) is reported in NPTA.¹²¹ A 1.9% incidence of hemorrhage has been reported in children younger than 5, and a 4.9% in children older than 16. The risk of hemorrhage is lower with “cold” dissection (1.3%), than with “hot” techniques: adjusted OR (IC 95%) for monopolar diathermy = 2.71 (1.63-4.49); for bipolar diathermy = 2.47 (1.81-3.36); for coblation = 3.07 (2.03-4.65). Risk is lower in women (OR = 0.82; 0.73-0.93). Gathered evidence is not enough to prove the effectiveness of various haemostatic agents, such as bismuth subgallate,²¹²⁻²¹³ racemic adrenaline,²¹⁴ haemostatic thrombin gel,²¹⁵ sponges²¹⁶⁻²¹⁷ or fibrin spray,²¹⁸ and the use of argon beam coagulation²¹⁹ in reducing intraoperative bleeding and/or the risk of postoperative hemorrhage. (Level of evidence II)

Recommendations

II/D Local application of pastes or sponges or the use of argon beam coagulation for the prophylaxis of hemorrhage after tonsillectomy and/or adenoidectomy, is not recommended, due to the lack of available evidence.

Prophylaxis and treatment of postoperative pain and vomiting

Postoperative pain

New evidence from a systematic review²²⁰ and from another randomized study²²¹ reports the effectiveness of administering intravenous dexamethasone immediately before tonsillectomy in reducing postoperative pain in children. (Level of evidence I)

Benefits are obtained without side effects and at a low cost. A single 10 mg dose of intravenous dexamethasone reduces pain also in adults.²²²⁻²²³ (Level of evidence II)

Evidence is contrasting on the effects of NSAIDs in preventing and treating postoperative pain after tonsillectomy. A Cochrane systematic review,²²⁴ assessing the effects of NSAIDs on postoperative bleeding in children, shows that evidence is not enough to advice against postoperative use of NSAIDs. A metanalysis reports a higher risk of hemorrhage after tonsillectomy with aspirin, but not with diclofenac and ibuprofen.²²⁵ Two systematic reviews reports instead a higher risk of reintervention due to postoperative bleeding in adults and children who were administered NSAIDs, but not of intraoperative bleeding and secondary hemorrhage.²²⁶⁻²²⁷ A systematic review²²⁸ and some randomized studies comparing NSAIDs with other analgesics or with placebo in adults²²⁹⁻²³³ and in children²³⁴⁻²³⁵ do not provide final evidence on type, dosage and safety.

Humunen’s systematic review²²⁸ and four randomized studies indicate paracetamol, alone or combined with codeine, as useful in controlling postoperative pain in children.^{183,236-238} (Level of evidence II)

A Cochrane review²⁴² on the effectiveness of local anesthetics, and a large part of the most recent randomized trials²⁴³⁻²⁵¹ suggest that local anesthetics are not superior in the treatment of postoperative pain. (Level of evidence I/II)

Postoperative nausea and vomiting

Strong evidence from two systematic reviews²⁵²⁻²⁵³ and one subsequent randomized study²⁵⁴ proves the effectiveness of one single dose of intravenous dexamethasone in reducing to 50% the risk of postoperative vomiting in children who underwent tonsillectomy and in shortening (one day) the time needed to return to normal diet. (Level of evidence I)

The effectiveness of dexamethasone in preventing vomiting has been proven also in adults.²²³ (Level of evidence II)

Bolton's systematic review²⁵² and three randomized studies funded by industry²⁵⁵⁻²⁵⁷ show the effectiveness of several anti-serotonergic drugs (ondansetron, granisetron, tropisetron, dolasetron, ramosetron) and of methoclopramide,²⁵² even if weaker, for antiemetic prophylaxis in children undergoing tonsillectomy (level of evidence I) A randomized study reports the effectiveness of perphenazine in preventing postoperative vomiting.²⁵⁸ (Level of evidence II) NSAIDs have been found to be effective in reducing nausea and vomiting in children who underwent tonsillectomy, when compared to placebo or other analgesics.^{224,227} (Level of evidence I)

Recommendations

I/A Administration of paracetamol is suggested before surgery (20 mg/kg, orally) and after surgery (15 mg/kg) each 4 hours, eventually associated to codeine, to prevent pain in children and adults.

I-II/A Preoperative administration of intravenous dexamethasone (0.5-1 mg/kg in children to a maximum of 8 mg; 8 mg in adults) is recommended to prevent postoperative pain and vomiting and to shorten the time needed to return to normal diet.

I/D The routine use of NSAIDs to prevent and control postoperative pain is not recommended, due to the higher risk of bleeding.

I/A Postoperative use of local anesthetics in peritonsillar region is not recommended.

I/E The use of acetylsalicylic acid-based drugs (aspirin) is not recommended after adenotonsillectomy, due to the risk of bleeding and of their association to Reye syndrome in children.

GCP Children should not abstain from eating for more than 4 hours and from drinking for more than 2 hours before surgery, to prevent postoperative dehydration.

GCP Infusion therapy with isotonic electrolyte solution is recommended for the treatment of an eventual postoperative dehydration, avoiding the use of glucose solutions without sodium.

Tab 2. Recommended scheme for perioperative management of children undergoing tonsillectomy

Postoperative management of children undergoing (adeno)tonsillectomy (from White 2005, ²⁵⁹ modified)	
Premedication	Anaesthetic cream to insert intravenous line in children 20 mg/kg of oral paracetamol
Induction	Inhaled anaesthetics (sevoflurane) or intravenous drugs Intubation with or without myorelaxants
Perioperative period	Short-term antibiotics 1-2 µg/kg of intravenous fentanyl 0.5-1 mg/kg (a maximum of 8mg) of dexamethasone, after induction Intraoperative maintenance: oxygen, peroxide, sevofurane or desfurane Fluids: 10 ml/kg of Ringer's lactate
Antiemetic prophylaxis	No
Morphine	No
Recovering phase	Analgesic, if necessary: 0.5 µg/kg of intravenous fentanyl Antiemetic, if necessary: 20-40 µg/kg of intravenous perphenazine or granisetron
Postoperative analgesics	15 mg/kg of oral paracetamol each 4 hours 1 mg/kg of oral codeine whenever necessary
Postoperative antiemetics	20-40 µg/kg of intravenous perphenazine or granisetron

Postoperative complications

Sore throat and earache, halitosis, uvular edema, difficulty in eating, stiff neck, malaise or prostration, fever, vomiting and dehydration can occur after adenotonsillectomy.^{16,260} All treatment used to control postoperative morbidity have been described in the previous chapters.

It is useful to divide post-tonsillectomy complications in the following groups.

Hemorrhagic complications

Hemorrhage, previously considered, is the most threatening and frequent complication after tonsillectomy. It can be caused by aberrant veins.²⁶¹

Anesthesiological complications

Anesthesiological complications include anaphylactic shock, respiratory depression, a complication for which OSAS children are particularly at risk, and malignant hyperthermia.

Infective complications

Cases of bacterial meningitis in children,²⁶² of endocarditis^{16,263} and two cases of necrotizing fasciitis after tonsillectomy are reported, one in the retropharyngeal tissues of a 2-years-old child, the other at a cervical level in a 39-years-old man with immunodepression.²⁶⁵

Some cases of Grisel's syndrome have been reported, characterized by atlantoaxial subluxation, persisting neck pain and rigidity, due to the spreading of the infection from the tonsil site to the transverse ligament of the atlantoaxial articulation.²⁶⁶⁻²⁷⁰

A case of septic hip arthritis or Lemierre's syndrome has also been reported, starting three days after tonsillectomy in a 9-years-old child who did not receive any antibiotic prophylaxis,²⁷¹ and a case of cervical osteomyelitis.²⁷²

Neurological complications

Lesions of the lingual branch of the glossopharyngeal nerve have been reported with subsequent alteration of taste,²⁷³⁻²⁷⁵ and lesions of cervical sympathetic fibers with subsequent onset of Horner's syndrome, characterized by ptosis, myosis, anhidrosis and enophthalmos.²⁷⁶

Hematological complications

Cases of hemolytic crisis are reported in patients with sickle-cell anaemia.²⁷⁷

Traumatic complications

Cases of luxation or dysfunction of temporomandibular articulation are reported, along with cases of mouth lesions (uvula, tongue and dental arch),¹¹⁹ velopharyngeal insufficiency,²⁷⁹ subcutaneous or mediastinal emphysema²⁸⁰⁻²⁸¹ and one case of external carotid artery pseudoaneurysm.²⁸²

Perioral burns are also reported after adenotonsillectomy carried out with monopolar diathermy and coblation.²⁸³

Clinical and organizational aspects of adenotonsillectomy

Healthcare

Tonsillectomy and adenoidectomy are included in the “Orientation and exemplification list of surgical interventions and procedures that can be carried out in day surgery as an alternative to hospitalization”, part of the agreement between the Italian Ministry of Health and the Regions approved in 2002.²⁸⁴ Adenoidectomy is included among the day surgery procedures, while tonsillectomy is included among those requiring day surgery followed by an overnight stay (one day surgery). These indications were already included in the 2003 PNLG document.

A progressive increase of tonsillectomies and adenoidectomies carried out in (one) day surgery has been registered in Italy from 2001 to 2004: from 23.9% to 48.8% for tonsillectomy with or without adenoidectomy; from 41.6% to 66.7% for adenoidectomy. Wide geographical differences persist as regards tonsillectomy in the use of (one) day surgery (60.6% North, 37.5% Centre, 35.8% South).

Case studies included in literature,²⁸⁵⁻²⁸⁷ and a systematic review²⁸⁸ show that adenotonsillectomy can be safely carried out in day care in adults and children older than 3, without contraindications. (Level of evidence V)

An Italian study, with one day surgery procedures, reached the same conclusion.²⁸⁹ Studies list a series of factors determining success: careful nurse assistance,^{286,289} correct information and communication with patients and relatives,²⁸⁹⁻²⁹⁰ counseling before discharge²⁹¹ and involvement of general practitioners.²⁸⁹ (Level of evidence V)

Postoperative observation should not be necessarily prolonged, as the onset of postoperative complications, in particular hemorrhage, appears to be limited to the first 4-8 hours after surgery.^{286,292} (Level of evidence V)

The systematic review shows that children younger than 3 are at higher risk of early postoperative complications (hemorrhage, respiratory distress, vomiting, dehydration and pain) and of re-hospitalization, when compared to older patients.²⁸⁸ (Level of evidence V)

Three randomized studies show the importance of information and audiovisual supports in reducing anxiety in children and parents and for the management of postoperative pain.²⁹³⁻²⁹⁵ (Level of evidence II)

Recommendations

V/A Tonsillectomy can be safely carried out in one day surgery followed by overnight observation.

V/A Adenoidectomy can be carried out in day surgery without overnight stay.

VI/A The following social requirements should be met in order to carry out surgery in (one) day surgery:

- patients (or their relatives) should be able to understand and follow the indications prescribed after discharge;
- a capable and responsible relative should accompany the patient to hospitalization and assist him/her during the hours following surgery;
- adequate domiciliary hygienic conditions and the availability of a telephone should be guaranteed;
- patients should stay in a structure not farther than one hour from the hospital in which surgery has been carried out.

VI/A Tonsillectomies should be carried out in hospitals providing intensive care 24 hours a day.

GCP Adequately trained personnel should attentively watch over patients after surgery to promptly intervene in case of complications – mainly in case of bleeding in children – and activate the emergency procedure.

V/A Patients and their relatives should receive a complete oral and written information before discharge on the attitude to be taken during convalescence at home and in case of complications, even through direct phone calls.

II/B Audiovisual material and/or information leaflets for children and parents are useful to reduce preoperative anxiety and improve the management of postoperative pain.

Informed consent

All healthcare intervention in Italy need the preventive consent of patients, to promote people's autonomy in health choices. An example of informed consent form for tonsillectomy is available on the Italian ENT and cervico-facial surgery Society's website: www.sioechcf.it.

Characteristics of hospitalization in children

The 2006-2008 Italian National Health Plan, in the chapter related to "Health in early life, childhood and adolescence", reports that the peculiarity of pediatric age in relation to hospital care should be respected reserving specific spaces to children.²⁹⁶

A European Parliament resolution indicates that children have the right to be hospitalized with other children, avoiding to be hospitalized with adults.²⁹⁷

The Mother-infant Objective Project included in the 1998-200 Health Plan recommends for perioperative assistance in children:

- receive children in a welcoming environment, not too noisy nor too overcrowded with visual stimulus, and along with parents;
- administering a pre-anesthesia guaranteeing a good level of sedation;
- organizing everything needed to allow children to spend all preoperative period and recovery along with at least one parent, to whom the access to the preparation/wake up room should be allowed.

Recommendations

VI/A Children should be hospitalized in structures with adequate spaces accounting also for their young age.

VI/A Children younger than 3, at higher risk of complications after tonsillectomy, should be admitted in hospitals equipped with intensive care units capable of assisting children.

Role of the family pediatrician and general practitioner

The Italian National Health Plan underlines the need of merging the different levels of an healthcare based on the communication and participation of professionals, to guarantee patients' care and continuous assistance.²⁹⁶

Multiprofessional integration between pediatricians or general practitioners and ENT professionals, as regards adenotonsillar pathologies, seems to be necessary for diagnosis, choice of treatment, hospitalization and postoperative care.

An effective communication between general practitioners and patients or their relatives is equally necessary to correctly assess the frequency and severity of secondary symptoms, as reported by this guideline in relation to OSAS and recurrent tonsillitis.

Recommendations

GCP Pediatricians or general practitioners should act as coordinators in the diagnosis of adenotonsillar pathologies, in particular in children with suspected OSAS. An integrated multidisciplinary, clinical and instrumental, approach is required, along with a careful assessment of eventual comorbidity affecting the evolution of symptoms.

V/B Pediatricians and general practitioners should be actively linked to the hospital in which surgery is carried out, to assure continuous assistance.

GCP Pediatricians or general practitioners should, after adenotonsillectomy, participate to the clinical assessment needed to define whether patients recovered or need further assistance.

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