

Anesthesiological management of adenotonsillar surgery in pediatric setting: the experience of the Spoke Center E. Profili in Fabriano

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Keypoints

Adenotonsillectomy is the most frequent otorhinolaryngological surgical procedure performed in pediatric age. In E. Profili Hospital in Fabriano, a Level I Spoke center, in order to guarantee an appropriate anesthesiological care for the needs and specificity of the pediatric patients and families, the organization of an adequate perioperative path is of crucial importance.

Abstract

Adenotonsillectomy is the most frequent otorhinolaryngological surgical procedure performed in pediatric age, where the surgical and anesthesiological field overlap and must be shared; it presents a non-negligible risk of postoperative morbidity and complications and must always be performed in optimal conditions of appropriateness and safety. In E. Profili Hospital in Fabriano, a Level I Spoke center, in order to guarantee an appropriate anesthesiological care for the needs and specificity of the pediatric patients and families, the organization of an adequate perioperative path is of crucial importance, starting from the preoperative anesthesiological evaluation, then continuing on the day of surgery with a proper anesthesiological management until the discharge of the patient after a careful postoperative monitoring.

Keywords

Pediatric adenotonsillectomy, adenotonsillectomy perioperative care, pediatric perioperative laryngospasm management

Introduction

Adenotonsillectomy consists in the surgical resection of the palatine tonsils, located in the tonsillar lodges, and of the adenoids, located in the nasopharyngeal vault. Surgical removal of tonsils is one of the most frequently performed pediatric surgeries in Western countries.

Resection of tonsils and adenoids is considered the first-choice treatment in significant forms of Obstructive Sleep Apnea Syndrome (OSAS) in children associated with adenotonsillar hypertrophy⁽¹⁾. There is evidence that OSAS causes craniofacial and dental arch alterations, and that tonsillectomy is effective in normalizing the orthognathic system⁽²⁾.

The diagnosis of OSAS is based on a detailed medical history and physical examination, as well as pulse oximetry and if required, polysomnography. Other indications for adenotonsillectomy include severe forms of tonsillitis and/or recurrent otitis and a history of peritonsillar abscesses⁽¹⁾.

Among the surgical complications of adenotonsillectomy, postoperative bleeding represents the most frightening and frequent one; more rarely, velopharyngeal insufficiency with oro-nasal reflux, temporomandibular joint dysfunction or dislocation, subcutaneous or mediastinal emphysema, and pseudoaneurysm of the external carotid artery may occur⁽¹⁾. Pain and dysphagia are common in the postoperative period and tend to regress spontaneously in the first few days after surgery.

According to the guidelines formulated by SARNePI (Italian Society of Neonatal and Pediatric Anesthesia and Resuscitation) and SIAARTI (Italian Society of Anesthesia, Analgesia, Resuscitation and Intensive Care), the management of a pediatric patient should be in charge of a specialized pediatric Hub in case of age less than 3 years, presence of major comorbidities or lack of pediatric anesthesiological expertise in the referring territorial Spoke⁽³⁾. Therefore, pediatric patients aged 3 years or older, with a weight over 15 kg and belonging to anesthesiological risk classes ASA I and ASA II are treated in our Level I Spoke center. On the basis of the National Guidelines to ensure a shared pathway for children between ENT and anesthesiologists from the time of admission to discharge, to improve the quality, safety and appropriateness of adenotonsillectomy procedures and to ensure appropriate care for the needs and specificity of the pediatric patient and families in our center Spoke has been identified and drafted a perioperative path defined for the pediatric patient. The anaesthesiological management of the paediatric patient therefore starts from the preoperative anaesthesiological assessment, continues on the day of surgery until the discharge of the patient after careful postoperative monitoring in a dedicated room.

Preoperative anesthesiological evaluation

Preoperative anesthesiological evaluation plays a crucial role in establishing a trustful relationship and a reassuring connection with both the parents and the patient and is part of the prehospitalisation pathway. The anesthesiological evaluation takes place in the presence of both parents and is scheduled as close to the surgery as possible. On the day of the visit, parents provide to the anesthesiologist the medical history certificate released by the pediatrician. The evaluation is based on the collection of the familiar, physiological and pathological history, both remote and recent, and on the execution of an accurate objective examination performed following a standardized procedure as much as possible, in order to ensure the completeness of the investigation, suggest the need for any further investigation and obtain the written informed consent of both parents (or legal guardian).

- **Anamnesis**^(4,5): an accurate familiar, physiological, pharmacological, remote and recent pathological anamnesis is collected. Particular attention is given to anesthesiological issues incurred in the family and personal setting (risk factors for malignant hyperthermia) as well as confirmed or suspected coagulopathies. Anamnestic evaluation of allergies to drugs, foods, latex, and tropical fruits (cross-reactivity with latex) is routinely performed, while the use of diagnostic allergy testing is reserved for patients with previous allergic reactions whose causes have not been identified.

The asthmatic patient, in the presence of an appropriate therapeutic management, continues therapy until the morning of surgery. The type of preoperative preparation is determined according to disease severity:

- Intermittent/ mild asthma: salbutamol aerosol 0.15 mg/kg 30-60 minutes before surgery;
- Moderate asthma: salbutamol + steroid aerosol 1 week before surgery;

- Severe asthma: salbutamol aerosol 1 week before surgery + prednisone 1-2 mg/kg per os 2 days before surgery.
- **Physical examination:** particular attention is given to factors predictive of difficulty in airway management (the Colorado Pediatric Airway Score is used for a global assessment) and to the presence of OSAS, also with regard to details obtained from the otorhinolaryngological evaluation; the examination continues with detailed assessment of the cardiovascular and respiratory systems. The psychophysical development of the child is also assessed by considering the specific report of the pediatrician.

Complete blood count, PT, PTT, CPK and ECG are routinely performed on all patients ^(4,6). Additional laboratory, clinical or instrumental investigations are performed if necessary following medical indication.

The anesthesiologist assigns the ASA class and provides all the information about preoperative fasting ⁽⁷⁾ and general anesthesia required to perform the surgery.

Preoperative fasting:

- 6 hours for light meals and artificial milk
- 4 hours for breast milk
- 2 hours for clear liquids

Elective surgery is postponed for 2-4 weeks if the patient shows: productive cough, body temperature higher than 38.5°, purulent rhinitis or lower airway involvement ^(4,5). The introduction of antibiotic therapy, if necessary, is evaluated by the pediatrician.

Perioperative anesthesiological management

The operating session for pediatric ENT surgery involves the execution of two surgeries consecutively with the start of activity at 8 a.m. with the first child entering the operating room in order to have the maximum time and resources for the performance of all pre- and postoperative procedures.

Pre-anesthesia

The patient is premedicated with midazolam per os (0.5 mg/kg to a maximum of 10 mg) in the presence and with

the support of parents, at least 30 minutes before arrival in the operating room.

Hospital unit nurses preemptively apply anesthetic cream (e.g., EMLA) to the back of the hands and elbow fold bilaterally, 30-60 minutes before entering the operating room, to increase patient comfort during subsequent procurement of peripheral venous access.

The nursing staff, together with one of the parents (preferably the mother), accompanies the patient to the entrance of the operating block, where the child will be accepted by the operating room staff. The anesthesiologist then verifies the patient's identity and reviews the patient's clinical and anesthesiological record.

Monitoring and induction of general anesthesia

Vital parameters (ECG, SPO₂, NIBP, temperature by spot-on and bispectral index with pediatric sensor) are monitored. Proper positioning of the patient on the operating bed is verified.

The nursing staff provides peripheral venous access placement, preferably 20G at the elbow fold, while the patient is awake; if this is not possible, facemask inhalation induction with sevoflurane 4-6% is delivered.

The patient is prewarmed by forced-air heating system. Induction of general anesthesia is performed through the intravenous administration of fentanyl 2 mcg/kg (in order to facilitate administration, dilution to 10 mcg/ml is preferred) and propofol 2-3 mg/kg. To counteract a bradycardic-tending heart rate, atropine 0.02 mg/kg may be administered.

After checking the patient's ventilability and calibrating NMT monitoring, rocuronium 0.6 mg/kg is administered (in order to facilitate administration, dilution to 1 mg/ml is preferred).

Orotracheal intubation ⁽⁸⁾

All oro-tracheal intubations are performed routinely using the video-laryngoscope; a set of disposable blades of various sizes, including a blade with a special curvature for difficult intubations, as well as devices for difficult intubations, such as Frova introducer and flexible

bronchoscope, are always immediately available for the anesthesiologist.

During video-laryngoscopic view, lidocaine 2% is nebulized on the vocal cords (maximum 3 mg/kg).

As soon as TOF = 0 is obtained, intubation is performed with stylet tube, chosen in advance according to the rule $no.tube = \frac{age}{4} + 4$ and then the cuff is inflated with air.

The depth of tube insertion is determined according to the empirical rule $depth = no. tube \times 3$.

Proper placement of the orotracheal tube is first verified by video laryngoscopy and then by EtCO₂ curve, pressure curve, and the presence of bilateral MV on auscultation. The orotracheal tube is then fixed, suction of the gastric content is performed and ocular globes are adequately protected with lubricating gel and atraumatic patch.

Intraoperative phase

During surgery and general anesthesia, routine monitoring includes ECG, SpO₂, NIBP, EtCO₂, spirometric curves, body temperature in continuous (spot-on sensor is preferably applied near the temporal artery or alternatively the carotid artery), TOF/PTC, and bispectral index (BIS) with dedicated pediatric sensor, the latter in order to verify the depth of the anesthesia level at all times.

Controlled ventilation is delivered in a protective regime (6-8 ml/kg).

The patient is actively warmed by physical means and forced-air heating systems in order to avoid hypothermia that can occur more easily in pediatric age due to the smaller body surface area than in adults.

Maintenance of anesthesia is achieved through administration of sevoflurane, indicatively maintaining a MAC of 1.0 (the depth of anesthesia is also controlled with BIS) and remifentanyl in continuous infusion 0.2-0.3 mcg/kg/min.

At the surgical incision, dexamethasone 0.1 mg/kg ev is administered for the prevention of Postoperative Nausea and Vomiting (PONV) and pharyngeal edema and tranexamic acid 20 mg/kg ev to limit bleeding.

Awakening phase

At the end of surgery, hemostasis is carefully checked. Gastric and oral suction is performed with caution to avoid excessive stress on the operated districts.

Delivery of sevoflurane and remifentanyl is then interrupted.

Once a MAC value < 0.3 is reached, ventilation is switched to a supportive one in order to verify the recovery of spontaneous respiratory activity, to obtain adequate minute-ventilation to remove CO₂ (thus avoiding hypercapnia) and anesthetic vapor, and finally to promote alveolar recruitment. Safe extubation is performed once TOFr 100% is reached. If the child has valid spontaneous respiratory acts (>5 ml/kg) despite the patient is still sedated, extubation can be performed preferably at the end of the expiratory phase. The occurrence of coughing should be avoided as much as possible, as it can promote laryngospasm.

During awakening, the child should not be unnecessarily stimulated, and unhelpful stimuli, such as removing electroplate, repositioning underwear or sleepwear, should be avoided.

***Sugammadex*⁽⁹⁾**

One box of product (100 mg/ml) is available in each anesthesia cart in the operating block.

Dosages of 2 mg/kg are administered at the reappearance of T2; dosages of 4 mg/kg are used if recovery has reached a PTC of at least 1-2 (the use of lower doses is not recommended because it may lead to an increased risk of recurrence of neuromuscular blockade after initial antagonism).

To increase the accuracy of sugammadex administration, diluting the drug to 10 mg/ml may be considered.

Sugammadex is administered intravenously by a single bolus injection over approximately 10 seconds.

***Post-operative analgesia*⁽¹⁰⁾**

In the terminal phase of surgery, paracetamol 15 mg/kg is administered.

In the hospital unit, paracetamol 15 mg/kg is administered every 6 to 8 hours. Rescue dose of tramadol of 1 mg/kg every 8 hours may be considered.

In case of PONV, consider using ondansetron 0.1 mg/kg every 8-12 hours (not to be used in case of long QT).

Discharge from operating room

The child can leave the operating room when, once the respiratory support is removed, the following are present:

- Stability and adequacy of vital parameters according to age
- Breathing function: valid mechanics, respiratory rate adequate for age, absence of inspiratory and expiratory noises
- Hemodynamic function: HR in the normal range for age
- Age-related signs of regaining consciousness: infant is quiet, responds to tactile stimuli
- Controlled pain
- Absence of bleeding.

Postoperative monitoring

Once discharged from the operating room, the child is transported by the operating room nursing staff to the day surgery room contiguous to the Operating Block and ICU prepared with all the necessary equipment and supplies for pediatric care and dedicated to accommodate two children in the postoperative period where one of the parents and a dedicated nurse will be present for postoperative monitoring (NIBP, HR, SPO₂, body temperature, neurological status) that will be concluded with the transfer of the children to the ordinary inpatient unit.

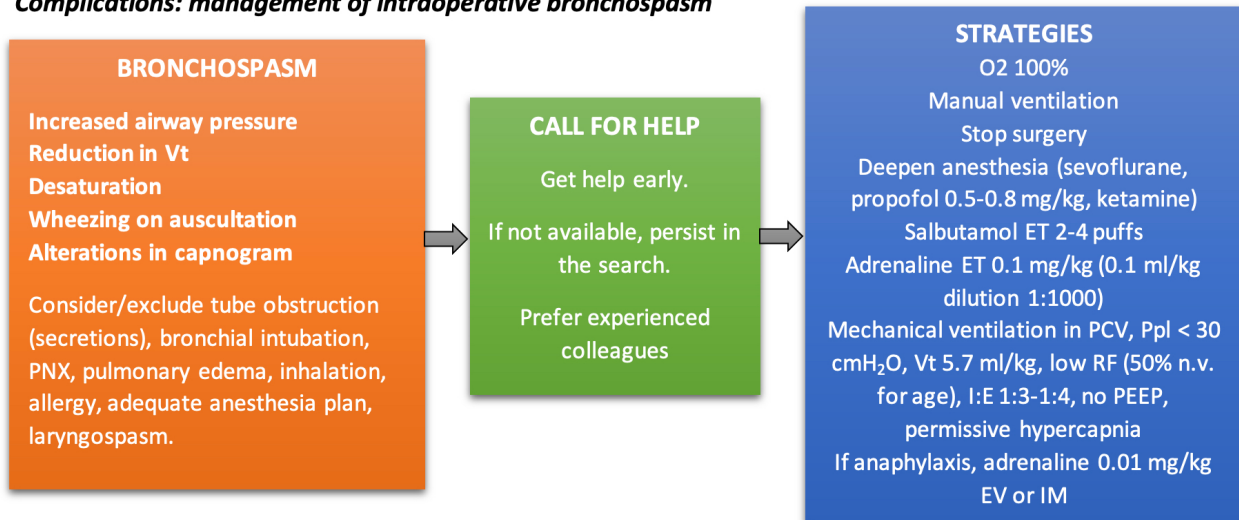
The patient may be transferred to the inpatient unit only after evaluation by the ENT and anesthesiologist, who checks respiratory function, hemodynamics, consciousness, pain (< 4 Wong-Backer scale, < 3 NRS), and body temperature.

Peripheral saturation monitoring continues for children presenting preoperatively with OSAS with associated:

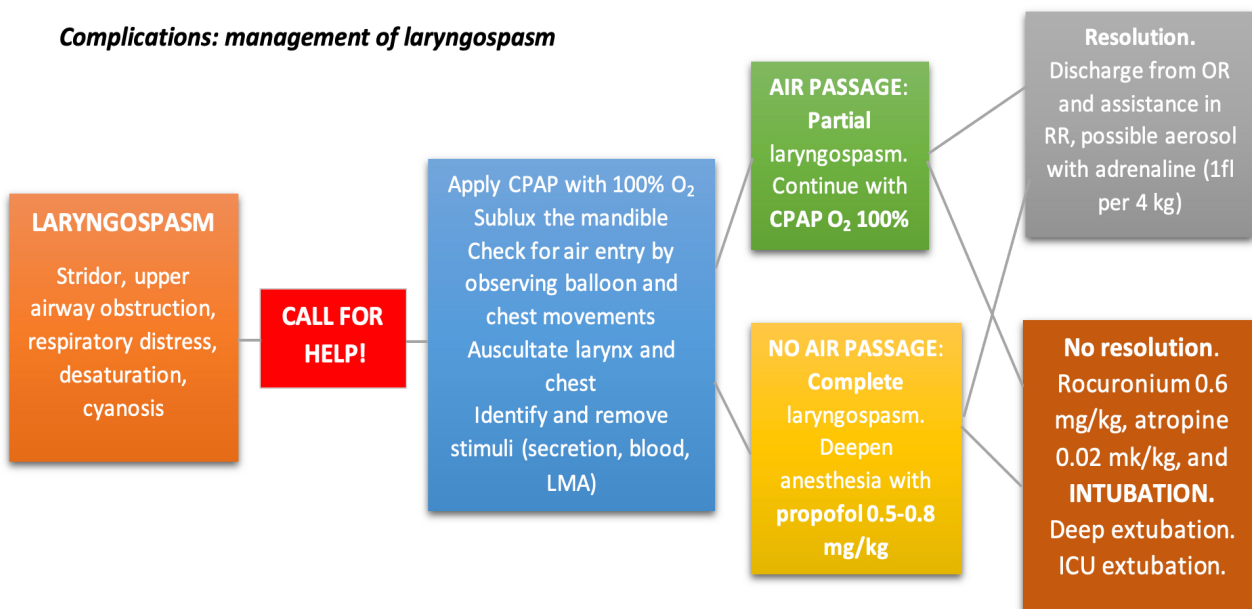
- Preoperative nadir of SPO₂ <80%

- Comorbidities such as asthma, Down syndrome, obesity, craniofacial abnormalities including retro or micrognathia and neuromuscular disorders.

Complications: management of intraoperative bronchospasm



Complications: management of laryngospasm



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