How do you plan anesthesia for an adenotonsillectomy in a morbidly obese 4 year-old admitted for respiratory failure, when the child and parents are uncooperative?

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Objectives:
1. Recognize the presentation and understand the diagnostic criteria for OSA in pediatric patients
2. Understand the implications of obesity in children undergoing anesthesia
3. Discuss the ethical dilemma of treating a child whose parents have minimal understanding of the situation and risks, and refuse critical components of care.
4. Identify ways to support ventilation postoperatively
5. Identify best postoperative analgesic options

Case history:
You are asked to consult on a 4 yo in-patient with obstructive sleep apnea (OSA) who is scheduled for a tonsillectomy and adenoidectomy (T&A). She was admitted with respiratory failure and was treated with BiPAP. She has since refused to use the BiPAP. You enter her hospital room and see a morbidly obese girl, weighing 55 kg (BMI of 37 kg/m²). You are unable to establish rapport with the child who buries her face in mom’s lap. The mother states that if her “daughter doesn’t want to do something, she won’t do it”. Mom is also unwilling to make eye contact or talk about the planned surgery, although she is adamant about refusing a “breathing tube” for her daughter. The father, who requires oxygen by nasal cannula, has severe narcolepsy and is unable to maintain a conversation or control his daughter to allow a limited exam. A brief glimpse of her profile reveals a normal appearing mandible.

You leave the patient’s room frustrated by your failure to do a preoperative evaluation, and without being able to discuss the case with the parents. You recall that 3 months earlier the courts removed an 8 year-old child from his home in Cleveland because of morbidity obesity.

Questions:
How do we define obesity? What is the incidence of obesity for children in the United States? What are the possible etiologies of OSA in any pediatric patient? What are the consequences of untreated OSA in the pediatric population?

Case history and physical examination (continued):
This 4 yo girl was admitted to the PICU 8 days previously for respiratory failure. She had a history of asthma, a current URI, and she was also diagnosed with obstructive sleep apnea (OSA) on admission. She was treated with BiPAP for the acute respiratory failure, but as she improved and became more alert she refused to continue with the mask even during sleep. After several days in the PICU, she was transferred to the floor.
Questions:
What preoperative studies would you request?
Is a formal sleep study of any benefit for this patient?

Preoperative studies:
Blood studies revealed: WBC = 18, Hb = 11, bicarb = 31, glc = 101. Electrolytes, LFTs, and renal function studies were normal. CXR was clear.
EKG revealed NSR, rate 123.
Echo (limited exam): LVH with normal motion, mild LVOT obstruction; predicted RVSP of 40 mm.
Sleep study results: 274 obstructive hypopneas, AHI = 48, mean $O_2$ sat = 93%, min sat = 76% on 1 L $O_2$, average HR = 137 (97 – 162)

Questions:
What is the significance of these lab findings?
How is a polysomnography exam performed? What can the sleep study tell us?
Define central apnea, obstructive apnea, obstructive hypopnea, and mixed apneas.
How is the severity of OSA classified?

Case planning:
It is Thursday when you are first consulted, and the ENT surgeon would like to schedule the case for Monday – a T&A, and possible tracheostomy. Again, the parents refuse to discuss and have difficulty understanding the issues, and they have not consented. They adamantly refuse to give permission for a trach, and also refuse to consent for postoperative intubation.

Questions:
Is T&A the appropriate first line of treatment for this child?
What are the anesthetic implications of obesity and OSA in pediatric patients undergoing anesthesia?
Using the ASA risk assessment scoring system for OSA, how would you define this patient's risk?
How can you ethically treat this child when the parents appear to be unable to understand or unwilling to discuss the implications of her disease and plan/risks of surgery?
What happens when she returns home?

Case progression:
A care conference takes place the next day with all caregivers present: ENT, pulmonary, anesthesia, pediatrics primary, social worker, psychology, county social services, parents, and aunt. The mother leaves the room in an emotional outburst, but her sister helps to bring her back. In the end, the father signs the consent for a T&A, as well as a possible trach if necessary to save her life.

Questions:
Now, how do you plan for anesthesia? She currently has an IV in place that may not last until Monday.
The case is scheduled to be the surgeons last case of the day – how will you keep her NPO when the family has been sneaking in fast food from outside?
How will you separate from the parents?
Will you insist on an IV being present prior to induction? Mask or IV induction? Endotracheal intubation or LMA?
Any special monitoring?

Intraoperative course:
We were able to separate from her parents in the holding area with the help of her favorite childlife specialist. Luckily the patient’s IV was still intact and we performed an IV induction. What would you do now if you experienced difficulty with mask ventilation? We were able to control her airway with an LMA, which was placed proactively. After we assured effective ventilation we administered muscle relaxant. Would you use muscle relaxant, and if so which one? The surgeon performed a diagnostic laryngoscopy to examine her airway and ensured there were no other abnormalities except significantly hypertrophied tonsils. The patient was intubated and the T&A proceeded uneventfully.

Questions:
Will you extubate her in the OR?
What will you use for postop analgesia?
Is it acceptable to use BiPAP postoperatively after a T&A?

Postoperative course:
After a brief surgery, the patient was extubated in the OR after a prolonged period of emergence and monitoring. A total of 0.2 mcg/kg of fentanyl had been administered prior to surgery and 10 mg/kg of IV Tylenol prior to the end. She was then monitored another 10 minutes prior to transport to the PICU. Postoperatively in the PICU, the patient received just one dose of 0.5 mg of morphine, and then analgesia was controlled with oral Tylenol. BiPAP was used for a few hours before she refused.

The patient was sent to the ward on POD #1. She was discharged to a rehab facility on POD #11, and spent 3 weeks working on diet, exercise, and adjusting to BiPAP (which was not successful). Five months later, the patient had lost 30 pounds, was no longer in diapers, and had caught up to her peers in language development, and was also better adjusted emotionally. A repeat sleep study had not yet been performed.

Discussion:
We are all aware that obesity is an epidemic in the United States, and studies show that almost 20% of American children are obese! The generally agreed upon definitions are: overweight is > 85th percentile BMI for sex and age, obese is > 95th percentile BMI for sex and age. Along with the increase in weight come a number of potential health issues such as diabetes, obstructive sleep apnea, metabolic syndrome and cardiac disease. Obesity influences ventilation in a number of ways: deposition of fat in the tissues causes a decrease in the pharyngeal lumen and increased collapsibility of the upper airway, cephalad displacement of the diaphragm when the patient is supine leads to a decrease in FRC and oxygen reserve, and decreased chest wall compliance increases the work of breathing.

The etiology of OSA is essentially a dynamic imbalance in upper airway function. In the pediatric population it is most often due to anatomical characteristics such as adenotonsillar hypertrophy, obesity, or craniofacial abnormalities. It may also be due to abnormal neuromotor function as may be seen with cerebral palsy or the hypotonia of Down syndrome. In our patient, it is likely
due to the combination of obesity and adenotonsillar hypertrophy. Unfortunately, she will still be left with the weight issue after surgery.

Consequences of OSA in the pediatric population are somewhat different than in adults. Occasionally children will display hypersomnolence, but more often they display hyperactivity or aggressiveness, poor attention, and poorer performance in school. They show decreases in measures of executive function. There may be effects on the cardiovascular system such as systemic hypertension, ventricular hypertrophy, or even pulmonary hypertension leading to right heart failure. These are the effects of sustained sympathetic activation and endothelial dysfunction.

A sleep study, or polysomnography, is the definitive study for the diagnosis of sleep apnea and is able to differentiate between central apnea, obstructive apnea, obstructive hypopnea, and mixed apneas. The definition of central apnea is a pause in airflow with absent respiratory effort, scored when \( \geq 20 \) s or two missed breaths and a \( > 3\% \) drop in oxygen saturation. Obstructive apnea requires a 90\% reduction of airflow despite continuing respiratory effort, scored when the event lasts at least two missed breaths in children. Obstructive hypopnea requires 50\% reduction of airflow with associated respiratory effort, scored when at least two missed breaths and a 3\% drop in oxygen saturation or arousal occurs. The severity of sleep apnea is based on the apnea hypopnea index (AHI). Mild OSA = 2-4 events/hour, moderate = 5-9, and severe is \( > 10 \) events/hour and an oxygen saturation nadir of \( < 80\% \). Based on our patient’s AHI of 48, and oxygen saturation down to 76\% (on oxygen), our patient clearly has a diagnosis of severe sleep apnea.

Studies have looked at the outcomes of children with OSA who underwent T&A, differentiating normal weight and obese children. A Singapore study found that 80\% of all children were cured, and the majority of obese children had significant improvement, with 30\% achieving a cure. The results depend on the severity of obesity and the severity of the respiratory disturbance index.

Patients with sleep apnea undergoing anesthesia do have a higher risk of airway difficulties as well as intra and postop desaturation events. The ASA has created a risk assessment scoring system for patients with sleep apnea. There are 3 areas scored: the severity of sleep apnea, the invasiveness of surgery, and the requirement for postop opioids. Each area is scored on a scale of 0-3, so a patient with a score of 9 is at the highest risk.

It is commonly known, and seems obvious, that OSA patients with chronic hypoxemia are more susceptible to the respiratory depressant effects of opioids, but perhaps less well known is that they are also more sensitive to the analgesic effects of opioids. So they may be comfortable with less medication.

In the past, it was generally felt that CPAP or BiPAP was contraindicated after surgery on the airway, following case reports in the ENT literature describing subcutaneous emphysema and pneumomediastinum/pneumothorax after T&A. Although there was no relationship to positive pressure airway support, the hypothetical risk was assumed. More recently, reports of BiPAP use in children after T&A have appeared in the literature with no negative effects.

In summary, the obese child with OSA undergoing adenotonsillectomy is at increased risk in the perioperative period and deserves a level of care adjusted to the severity of disease. It is likely
that cases like this will become more common in our practices and will utilize a significant amount of healthcare resources. The procedure alone may not provide a cure, but will hopefully be a stepping-stone to improved health with continued patient and family education and support for a healthier lifestyle.

References: