Anesthesia for patients with subglottic cysts

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Introduction

Subglottic cysts (SGCs) are a rare pediatric diagnosis with an estimated incidence of 1.9 per 100,000 births [1, 2]. They are of concern for the anesthesiologist because they can rapidly progress to severe respiratory distress and complete obstruction. Patients with subglottic cyst may require anesthesia for procedures such as flexible or rigid bronchoscopy and subglottic cyst excision. Here, we present a case of acquired subglottic cysts, discuss the natural history of SGCs, and makes recommendations for the perioperative anesthetic management of these patients.

Case

A 4-month-old ex-26 week male infant, weighing 5 kg, with a past medical history significant for bronchopulmonary dysplasia and chronic lung disease presented to the Emergency Department (ED) after rapidly developing stridor and respiratory distress. His parents denied any viral prodrome. In the ED, he was given albuterol and atrovent with minimal improvement. A fiberoptic laryngoscopy performed by an otolaryngologist showed mild laryngomalacia. He was discharged home on methylprednisone with the diagnosis of viral upper respiratory infection and scheduled for follow-up with his pediatrician the next day. At home, the patient’s condition worsened, prompting the parents to return to the ED. En route, they noted that he became quiet and cyanotic at which point they pulled over and called 911.

In the ED, the patient was started on continuous albuterol nebulizers and given a loading dose of terbutaline. A venous blood gas at that time revealed a pH of 7.27 and PCO₂ of 55. He was admitted to the PICU and his respiratory support was escalated to CPAP of 5 and eventually to BiPAP of 17/7.

In the PICU, the pulmonologist noted biphasic stridor worsening with agitation on exam. The absence of wheezing on exam made him question the diagnosis of reactive airway disease, and he recommended discontinuing the albuterol for concern of causing airway collapse in patients with bronchomalacia. He also recommended an emergent direct laryngoscopy and rigid bronchoscopy under general anesthesia be performed.

On the day of the procedure, the patient was maintained on BiPAP en route to the OR. After receiving 1 mg/kg of ketamine via an in situ IV, he was transitioned to a face mask with CPAP and gentle bag-mask ventilation.
assistance. The patient was allowed to spontaneously breathe Sevoflurane. The patient’s vocal cords were topi-
calized with lidocaine via an atomizer. On rigid bron-
choscopy, the patient was found to have enlarged
subglottic cysts occluding >90% of his trachea (Fig. 1A).
The cysts were marsupialized with cold steel instruments,
and the patient was intermittently masked with sevoflu-
rane. After cyst resection, the patient had dramatic
improvement in air entry and was returned to the ICU
spontaneously ventilating via a natural airway and was
discharged after 3 days.

Discussion

Subglottic cysts are classically a disease of preterm infants.
The typical history is a low-birth weight infant born pre-
maturely with respiratory distress requiring intubation
and management in the NICU [3]. In one series, over
90% of patients had a gestational age of 25–31 weeks [4].
Duration of intubation was usually several days (mean:
10–20 days) [3, 4]. Time to development of cysts ranged
widely from days to years with an average of 5 months
[3, 4]. The diagnosis of SGCs appears to be increasing,
which could be due to better survival of preterm infants,
improved anesthetic techniques, and improved scopes [5].
The mechanism of SGC formation is unknown, but postu-
lated to be iatrogenic phenomena caused by the
repeated piston trauma of the endotracheal tube and the
ventilator [6]. The subglottic region is the narrowest por-
tion of the pediatric airway. Subglottic ducts are present
in greater number in infants as compared to adults.
Injury and scarring of the subglottic mucosa is thought to
lead to blockage of the ducts and cyst formation [7].

Preoperative assessment of these patients should
determine the urgency and severity of symptoms. A birth
history should seek out other pathologies of prematurity.
One should seek out the diagnosis of bronchopulmonary
dysplasia, chronic lung disease, or reactive airway disease.
Prior anesthetic records can indicate the number and
duration of previous intubations as well as any history of
difficult intubations. Home medications should be
reviewed for bronchodilators, recent steroid courses, and
diuretic use. Baseline oxygen saturations as well as home
oxygen therapy or ventilator support should also be clari-
fied. Patients with severe symptoms or comorbidities
(e.g., lung disease or congenital heart disease) should have
a preinduction IV placed.

Preanesthetic preparation for airway procedures
requires close communication between the anesthesiolo-
gist and otolaryngologist. Intervening on the airway while
maintaining adequate oxygenation and ventilation
requires the cooperation of two distinct airway specialists
with differing priorities and skill sets. A mutual respect
and understanding of each specialty’s goals allows for
optimizing surgical conditions while maintaining patient
safety. The discussion should include the surgeon’s prefer-
ence for examining the airway under spontaneous ventila-
tion or with muscle relaxation. Contingency plans
including a plan for emergency tracheostomy in the event
of difficult ventilation or intubation should be delineated.

There are multiple approaches to safely anesthetizing
the patient with subglottic cysts. Premedication can help
calm patients and avoid worsening stridor. Patients
requiring ventilatory support should have it maintained
until induction of anesthesia in the OR. Even with a pre-
operative IV, a combination induction (inhaled with IV
agent) is useful for providing positive airway pressure,
controlling the speed of induction, maintaining sponta-
neous ventilation, and monitoring of airway patency.
Once the patient is induced, topicalization of the vocal
cords under direct laryngoscopy with a Laryngeal Tra-
cheal Anesthesia (LTA) device accomplishes two goals:
blunting airway reflexes and assessing depth of anesthesia
before proceeding with rigid bronchoscopy.
Maintenance of anesthesia can be accomplished with volatile agent or TIVA. TIVA with spontaneous ventilation using propofol and remifentanil has been described by Ferrari et al. [8]. Advantages are that it provides a tubeless, spontaneously ventilating patient reducing interruptions to the procedure. It also avoids contaminating the room with potent agents. The drawbacks are the added time required for titrating infusions to the narrow window of spontaneous ventilation and blunted airway reflexes. If TIVA is used, a dedicated, visible peripheral IV is desirable. In the absence of end-tidal CO2 monitoring, a precordial stethoscope is extremely useful for determining the quality of ventilation.

Maintenance with volatile agent requires intermittent masking or intubation. While masking, the stomach should be inspected for inadvertent insufflation. If intermittently intubating, an undersized, uncuffed ETT can reduce trauma and postoperative laryngeal edema. Volatile anesthetic cannot be delivered while the patient is extubated, requiring intermittent delivery of high concentrations at high flows. Typically, the hemodynamic consequences of this are well tolerated in pediatric patients, but may not be suitable in patients with impaired preload, SVR, or cardiac reserve. Apneic oxygenation via insufflation of supplemental O2 into the oropharynx increases the PaO2 and delays desaturation. Pediatric patients have roughly twice the oxygen consumption of adults and continue to accumulate CO2 during apnea. This approach may not be suitable for patients with pulmonary or intracranial hypertension.

The gold standard therapy is endoscopic marsupialization with either cold steel instruments or CO2 laser [3]. Once the cysts have been marsupialized, the improvement is often dramatic. After the procedure, the patient can be intubated for emergence or recovered via face mask. If there has been extensive manipulation of the airway, the patient should remain intubated and monitored in the ICU for the development airway edema. Most children require a repeat endoscopic procedure for reassessment. Recurrence has been estimated anywhere from 20% to 60% [5, 6] though this seems to be less with the use of cold instruments [9]. As the incidence of this pathology seems to be increasing, the anesthesiologist may encounter these patients more frequently in the OR. Their anesthetics can be performed in a variety of ways as long as attention is paid to adequate ventilation, communication between services, and the presence of contingency plans.

Conflict of Interest

None declared.

References