It's Just a Little Add-On!
Airway Deviation from a Neck Mass in a Super Morbidly Obese Pediatric patient

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LEARNING OBJECTIVES:

At the end of this PBLD, the learner will be able to:
1. Recognize changes in airway anatomy in children with morbid obesity
2. Discuss the necessary modifications required in anesthetic technique and drug doses in this population
3. Discuss strategies for securing the airway in an obese patient with a deep neck mass. Debate the techniques, pros, and cons, of 'awake' vs. 'sedated' fiberoptic intubation, and manage complications.
4. Review the different options that would allow for effective post-operative pain control in patients with obstructive sleep apnea.

Preoperative Assessment

A 12 y/o developmentally delayed African American male weighing 160kg and 5'4" tall presents to the ED with difficulty swallowing and air hunger of 6 hours duration. There is a visible soft tissue swelling in the neck that has rapidly increased in size over the last few hours, and displaced the tongue anteriorly. He is brought to the preoperative holding area without an IV. ENT wants to proceed with surgical management emergently. He has a limited mouth opening and a class 4 Mallampati score. He has excessive secretions in his oropharynx that he is having difficulty swallowing, and insists on sitting upright, leaning forward, with his tongue hanging out of his mouth or paces the room.

What is your differential diagnosis for this neck mass, air hunger and difficulty swallowing?
What are the changes in airway anatomy associated with morbid obesity?

How is obesity defined? What are the classifications of obesity?
Are there any tests that you would insist on prior to proceeding with the case?
Would you want to have a discussion with the surgeon? What are the key points to be discussed?

Preoperative Testing

CT scan shows a retropharyngeal mass with narrowing of the airway and deviation of the larynx to the left.

What is your plan for securing the airway?
What are the advantages of an awake fiberoptic intubation?
How would you counsel the patient and family about the risks of anesthesia in this patient?
What is your back up plan if fiberoptic intubation does not work?
What other aspects of the difficult airway algorithm could you use in this case?

Past Medical History

The patient has a past medical history of asthma and sickle cell disease. He has had 3 vaso-occlusive crises in the last year requiring hospital admission. Two years ago, he had an episode of acute chest syndrome after cholecystectomy. He is on sustained release morphine 30mg twice a day.

What do you want to include in your preoperative assessment given his history of sickle cell disease?
What is the pathophysiology of vaso-occlusive crises?
What are possible clinical manifestations of sickle cell disease?
How will this change your plan for management of the case?
Do you want any preoperative interventions or tests prior to starting the case?

Intra-operative course

The patient is very anxious and tearful in preoperative holding area and on arrival to the OR. You attempt to put monitors on but he becomes combative and will not cooperate.

How does this change your plan for induction and intubation?
What could you use to sedate this patient? Do you have to modify your drug dosing in this patient? If so, how?
What are the risks and benefits to performing a sedated fiberoptic intubation?

You sedate the patient and secure the airway with a fiberoptic bronchoscope. The ENT surgeons drain the retropharyngeal abscess, however there is still significant soft tissue edema.

What is your plan for post-operative disposition for this patient? Home vs. regular floor vs. ICU?
What kind of monitoring do you want for this patient post operatively?
Will you extubate the patient? If so what would be the plan in the event of the need for emergent re-intubation?
How do you want to manage postoperative pain control?

Postoperative course

You decide to leave the patient intubated with the surgeons in agreement, and admit him to the ICU.

What would be your suggestion to the ICU team as far as methods of ventilation?
What are options for sedation for this patient?
How does his history of sickle cell disease influence your choices for postoperative pain control and sedation?

An ICU staff member suggests that you change out the oral endotracheal tube for a nasal tube and states that it would be more comfortable. Would you agree to this?

On POD #3, the ENT team wants to attempt extubation. You still think this patient could be a difficult airway despite a decrease in the swelling.

Are there any tests you want prior to extubation?
How would you proceed with extubation of this patient?
Would you extubate in the ICU?

The patient is successfully extubated, however you are consulted on the pain service to assist with pain control and agitation in the setting of worsening upper airway obstruction.

What are your goals in the pain control of this patient now?
What options exist that can help you achieve these goals?
Given the patient's home use of morphine, does this influence your choice of pain control?

The patient also reports chest pain and has developed a cough and fever.

What is your differential diagnosis for chest pain postoperatively?
What are treatments to consider?

Discussion

Obesity in children is defined as a BMI >85% as overweight and BMI >95% as obese. The prevalence of obesity in children is increasing worldwide and approximately 20 million children are obese. The majority of the cases of childhood obesity are caused from excessive calorie consumption. Children who are obese can suffer from a number of comorbities including type II diabetes, polycystic ovarian syndrome, hypertension, hyperlipidemia, obstructive sleep apnea, nonalcoholic steatohepatitis, orthopedic conditions, gastroesophageal reflux and pseudotumor cerebri. Obese children also have decreases in function residual capacity (FRC), expiratory reserve volume (ERV), forced expiratory volume in 1s (FEV1) and diffusion capacity.

The pharmacokinetics of most anesthetic drugs are affected by obesity. There are not many studies in obese children examining drug doses, however succinylcholine has been shown to be dosed at total body weight because of increased pseudocholinesterase activity in obese pediatric patients. In studies based on obese adults and normal weight

children, lean body weight should be used in dosing propofol, thiopental and remifentanil, idea body weight for morphine and nondepolarizing neurmuscular blockers and total body weight for synthetic opioids and succinylcholine.

Failure to overcome airway problems in the pediatric population can result in hypoxia, the leading cause of perioperative morbidity and mortality in children. In obese children, the challenges for airway management are not only anatomical (redundant soft tissue) but also changes such as decreased FRC that can lead to faster development of hypoxia. Airway tools such as fiberoptic bronchoscopy can aid in securing a difficult airway, including one complicated by a deep neck infection.

Postoperative pain control in obese patients can be especially challenging, given the risk of opioid induced airway obstruction. A higher sensitivity to opioids can increase the risk of postoperative airway obstruction. Inadequate analgesia can also create respiratory problems such as atelectasis when patients are unable to cough and take deep breaths due to pain. Pain control can be effectively managed using a multimodal approach to spare the need for opioid medications. When possible, regional anesthesia, nonsteroidal anti-inflammatory agents (NSAIDs), acetaminophen, alpha 2 agonists, ketamine, pregabalin and gabapentin can be used solely or in addition to opioid medications in the control of pain posteroperatively.

Pain control is especially important in patients with sickle cell disease. Sickle cell disease occurs when a patient is homozygous for Hemoglobin S (HbS) that contains an abnormal **β** globin chain. The mutation occurs on chromosome 11 and results in the substitution of valine for glutamic acid. This results in deoxygenation of HbS and sickling of the red blood cell. Sickling then leads to clumping of the red cells, inflammatory reactions and endothelial damage. Clinical manifestations include painful vaso-occlusive crises, acute chest syndrome, hemolytic crises, splenic sequestration, and neurologic complications such as cerebrovascular accident. Preoperative assessment should include evaluation for any end organ damage, history of painful crises and acute chest syndrome, hydration status and hemoglobin. Intra-operative management includes possible blood transfusions, appropriate

hydration, temperature management and adequate pain control. Pain control in sickle cell patients can be achieved using opioids and NSAIDS. However, patients with severe disease and extensive past exposure to opioids may continue to have poor pain control despite increasing opioid doses. In these cases, adjuvants such as low dose ketamine may be an option to aid in pain control.

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