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Title: Evolving pneumonia in a 9-month old requiring placement of a chest tube – danger lurks in interventional radiology!

Goals:

1. Discuss the merits and risks of various anesthetic approaches to a child with pneumonia who requires chest tube placement.
2. Understand the invasive nature of *Staphylococcus aureus* pneumonia, including key findings that indicate it is the likely etiology of a patient's pneumonia.
3. Review the management of acute tension pneumothorax in a small child.
4. Discuss systems in place in other institutions that alert the anesthesia team about the severity of illness present in patients who are to undergo urgent procedures.

Case description:

A previously healthy 9-month old female admitted for pneumonia presents to Interventional Radiology for a chest tube. She has been in house for 2 days, after initially presenting with fever, tachypnea and retractions. IV antibiotics have helped her respiratory status somewhat, but her chest radiograph revealed a large parapneumonic effusion. A chest tube is necessary. She was scheduled for an early afternoon case in Interventional Radiology; however, the preceding cases ran over their scheduled durations causing this case to be bumped to add-on status. At 5 pm when the case started a different anesthesia team was assigned the case than had been in Interventional Radiology earlier in the day. The surgeon had discussed the case with the original anesthesia team, but not the add-on team.

An IV induction was done with propofol and fentanyl, and sevoflurane was added to deepen the plane of anesthesia. Direct laryngoscopy revealed a Grade 1 view and the patient was intubated with a cuffed ETT. The ETT was removed due to concern for esophageal intubation. Attempted mask ventilation resulted in obvious stomach and distention and no air entry on auscultation of anterior lung fields. The SpO₂ was 40% and falling quickly. Atropine was given to prevent bradycardia. Intubation was performed again and a code was called. The surgeon arrived to the code, and performed a chest X-ray with the in-room fluoroscopy equipment. A large pneumothorax as well as a very distended stomach were seen. A needle thoracostomy was performed with immediate improvement in ventilation, and a chest tube was placed as planned. The patient

continued to have severe bronchospasm anytime the plane of anesthesia lessened, so she was taken to the ICU post-operatively after neuromuscular blockade and on a high-dose propofol infusion. She ultimately made a full recovery after spending approximately 10 days intubated and sedated.

It turns out that the surgeon had discussed his concerns with the first anesthesia team that was assigned the case, but the signout concerns were not passed to the next team. The surgeon had planned to request that spontaneous ventilation be maintained and the patient not be intubated prior to the patient leaving the Holding Area. The patient was taken through the back doors and the surgeon was waiting by the front doors so no communication occurred. It also happened that the results of the patient's most recent chest X-ray were not communicated to the anesthesia team, and the preoperative evaluation only included the patient's initial chest X-ray from the day prior.

Currently, in our institution there is a system in which scheduled cases deemed high priority or high complexity are noted by a color code. This system is not in place for add-ons, however. There is a formal intra-op handoff procedure for anesthesia team members but not for a subsequent case where the staff has changed. The severity of this patient's condition was not made known to the anesthetizing team but it is also unclear if the admitting physician was aware of the rapidly changing process in this patient's chest. It is clear that the surgeon was aware of the tenuous status of the patient but communication failed when a human-to-human discussion was the only way the information could have been transferred.

Model Discussion Outline:

The case: A 9-month old with pneumonia presents for a chest tube to be placed in Interventional Radiology.

Questions: What organisms might be most likely to cause pneumonia in this age group? Does immunization status matter? Risk factors?

Case history (continued): It is hospital day 2 for this patient; despite IV antibiotics she continues to have increased work of breathing, retractions, and a 1L/min oxygen requirement. Her CXR (Image 1) on admission showed a large right-sided pleural effusion with lung infiltrate in the upper lobe. The left lung was clear and the heart was of normal size. The radiologist's impression states "Large right-sided pleural effusion with pneumonia. In absence of previous images this could be all acute and one must think of such causes as Staphylococcus".

Questions: Why would Staphylococcus be worthy of mention by the radiologist? What pre-op issues need to be addressed? Would you repeat the CXR? What is your preliminary plan – spontaneous vs mechanical ventilation, intubation vs mask technique?

Pre-op: The case is an add-on; it is now 5pm. The patient presents to Holding; SpO₂ is 99% on 1.5L/min n/c and she appears tachypneic with mild retractions but no significant distress. Lung fields have rhonchi throughout.

Questions: What factors might lead you to change your anesthetic plan? What is “conservative” management in this scenario? What constitutes the safest anesthetic for this patient? What would you mention to the family in terms of anesthesia consent? Bronchospasm? Post-op intubation with ICU admission? Oxygen desaturation? What complications are you anticipating?

Intraop: She has an IV. How will you induce? Is positive pressure ventilation ok and/or desirable? Why or why not? You elect to do a slow IV induction with propofol, fentanyl and sevoflurane aiming for a deep plane of anesthesia prior to intubation.

Questions: Will you use muscle relaxant? The surgeon states the chest tube placement will take him approximately 15 minutes. Would you use a cuffed or uncuffed ETT?

Case progression: The pulse oximeter indicates worsening hypoxia and despite the ETT being placed there is no etCO₂; what will you do first? Give atropine, muscle relaxant, epinephrine, or remove the ETT and mask ventilate? Mask ventilation results in obvious stomach distention and continued hypoxia. Laryngoscopy is repeated, the ETT replaced, albuterol is given, and the stomach is decompressed. Hypoxia continues. What is your differential diagnosis, and how will you proceed? A quick fluoro of the chest looks like this (Image 2). What management is warranted now? (Consider the following discussion areas: needle decompression of pneumothorax, neuromuscular blockade, propofol gtt, and administration of Albuterol.)

Questions: How will you treat severe bronchospasm? What might result from high ventilation pressures? How would tension pneumothorax due to a bronchopleural fistula (characteristic of *S. aureus* pneumonia) present? Where is an emergent needle decompression of the pneumothorax performed? How many treatments of bronchospasm can you list?

Post-op: The patient is transported to the ICU with the chest tube to suction, paralyzed and sedated with a propofol infusion.

Questions: What will you disclose to the family about intraoperative events? What is the expected course of MRSA pneumonia?

Systems issues: Do you routinely communicate with the surgeon (IR proceduralist) prior to such a case? What insight might they have that would influence the anesthesia plan? If a surgeon is concerned about potentially severe complications resulting from a case, how does your institution assure that there is heightened awareness surrounding the case? How are add-on cases prioritized at your institution? Are staffing ratios considered when prioritizing add-on cases?

References:

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