

Tension Pneumothorax with LMA Ventilation: A Rare Event During Pediatric Orthopedic Surgery

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Introduction/ Background

Tension pneumothorax is the accumulation of air within the pleural space, characterized by progressively increased pressure, requiring emergency decompression. While an uncommon intraoperative complication, it is most often associated with endotracheal tube (ET) intubation, rarely Laryngeal Mask Airway (LMA) ventilation¹. This medically challenging case presentation investigates the occurrence of tension pneumothorax during the closed reduction of a pediatric forearm fracture, using general anesthesia and LMA ventilation. Additionally, assessing the different causes of biases that could have contributed to intraoperative decision making.

Case Presentation

- 10 y/o male status post trip and fall over his bicycle, was found to have right wrist fracture of distal radius and ulna
- Attempted reduction in the ER twice with no improvement
- Returned six days later for closed reduction and possible percutaneous pinning
- Intraoperative: Patient received general anesthesia via LMA~ uneventful
- Closed reduction of wrist was attempted, at which time patient became tachycardic, hypertensive, and desaturated to 61%, with increasing peak airway pressure leading to difficulty with ventilation
- Treatment for bronchospasm was initiated, however patient continued to desaturate- signs of tension pneumothorax manifested with hypotension and further increase in peak airway pressure
- Fluoroscopy showed a left- sided tension pneumothorax (thought to be secondary to bronchospasm)
- There were decreased left chest rise and no breath sounds, subsequent needle thoracostomy was performed by anesthesia
- Emergent L sided chest tube placed (28 Fr, 5th intercostal space mid-axillary line) and attached to Pleur-evac™ to suction
- Oxygen sat improved immediately, the chest tube was secured to skin and position of the tube confirmed via intraoperative fluoroscopy
- Patient transferred from PACU to PICU for management of chest tube

Patient Vitals

- Before incision: 93/39 (65) HR 81 SPO2 99%
- 17 minutes post-incision: Needle decompression
- 2 minutes post-incision: 188/101 (152) HR 165 SPO2 100%
- 20 minutes post-incision: Chest Tube
- 10 minutes post-incision: 102/42 (79) HR 139 SPO2 75%
- 25 minutes post-incision: 91/48 (74) HR 115 SPO2 94%
- 15 minutes post-incision: SPO2 trough 65%

Discussion

Cause	Mechanism	Supporting Evidence
Bronchospasm	Increased airway resistance + hyperinflation	Rising peak airway pressures and desaturation
Barotrauma from PPV	High inspiratory pressure during PPV	Rising peak airway pressures
Prior Pulmonary Trauma from Fall	Unrecognized pulmonary contusion (worsened with PPV)	Traumatic injury/ high energy fall 1-week prior

Table 1. Differential Causes of Tension Pneumothorax in this Patient

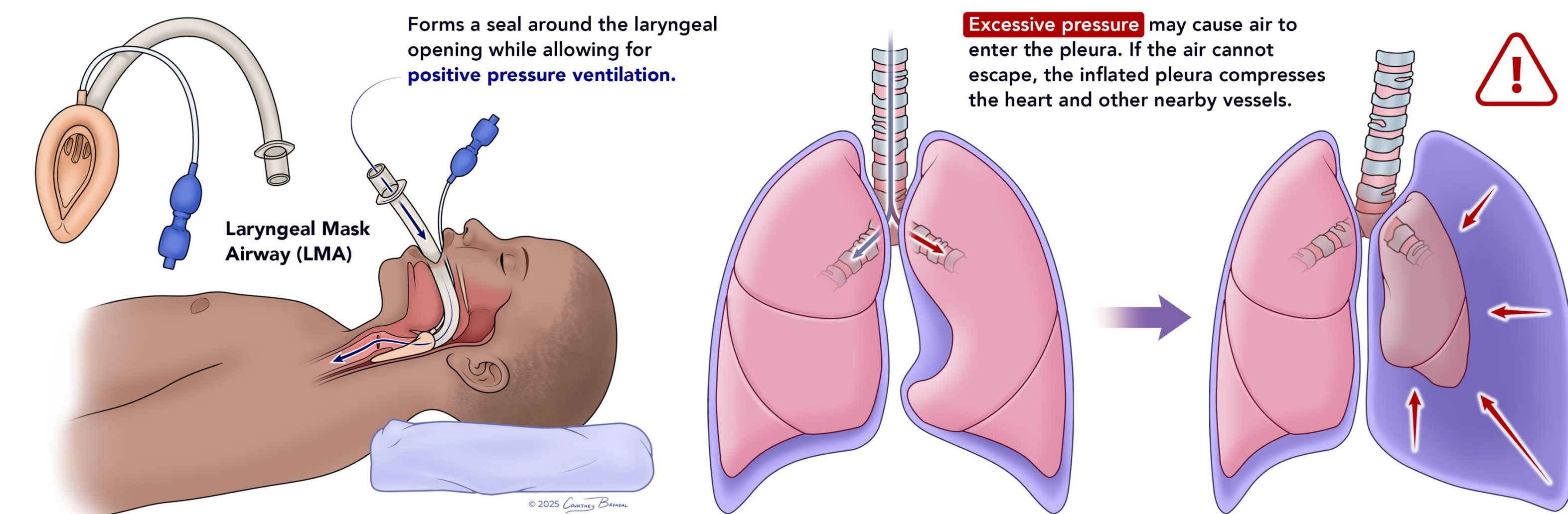


Figure 1. LMA ventilation and excessive positive pressure causing tension pneumothorax.

Discussion

- The presenting symptoms in the patient were first thought to be due to bronchospasm and were treated as such
- Both bronchospasm with air trapping and tension pneumothorax present with similar symptoms and are negatively impacted by positive pressure ventilation²
- Left sided pneumothorax can be harder to diagnose clinically as absence of breath sounds can be attributed to unintended right bronchial intubation²
- Additionally, severe bronchospasm can lead to absent breath sounds “silent lung”³
- While ET tubes are more commonly associated with barotrauma, LMA's do not eliminate this risk¹

The majority of anesthesiologists in the room **disbelieved** the possibility of **tension pneumothorax with an LMA**. Why was this the case?

Discussion- Types of Bias

1) Anchoring Bias

- Definition: **Focusing on a single, often initial piece of information** without adjusting to later information⁴
- “Tension pneumothorax does not happen with an LMA”- clinicians dismissed this diagnosis due to preconceived beliefs of LMA
- “The change in vital signs were likely due to the surgical stimulation”- hypertension and tachycardia happened right after the incision
- Anchoring on initial diagnosis- Even after absent L breath sounds were detected, 3/5 anesthesiologists stayed anchored on bronchospasm
- Anchoring on need for objective proof- Waiting for fluoroscopy delayed decisive action despite classic clinical signs

2) Group Think

- Definition: **Premature consensus seeking in cohesive groups**⁵
- The majority of anesthesiologists believed in bronchospasm, leading to a group consensus that excluded alternative possibilities
- Dissenting anesthesiologists suspected a pneumothorax but felt it difficult to challenge the prevailing opinion of “tension pneumothorax does not happen with an LMA”

3) Availability Bias

- Definition: **Selecting a diagnosis because it is at the front of mind**⁶
- Bronchospasm is a more common intraoperative complication therefore it dominated the differentials

Conclusion

- This case shows that tension pneumothorax can occur even with ventilating with an LMA
- Rapid recognition is critical: Delay in diagnosis can quickly lead to cardiovascular collapse.
- Being aware of cognitive biases and maintaining a broad differential will aid in timely patient care and safety
- Strategies for reducing bias include: Team based-decision making, use of clinical decision support systems, awareness of fatigue, and healthcare simulation⁶

References

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