Fentanyl-Induced Wooden Chest Syndrome Masquerading as Severe Respiratory Distress Syndrome in COVID-19

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**Case Presentation**

### History
- 47 yo M with no PMH presented with fever and respiratory distress
- Admitted for COVID-19 pneumonia

### Hospital Course
- Intubated for moderate acute respiratory distress syndrome (ARDS) on hospital day 11
- Fentanyl infusion started
- Hypoxia improved within 3 hrs but plateau pressures consistently >30 cm H2O despite minimizing dead space
- Trial of airway pressure release ventilation worsened hypercarbia
- Bronchoscopy w/o mucous plugging, airway collapse, or purulent secretions
- Lung compliance worsened (Pplat=50 on 4 cc/kg) w/o change in ventilation
- Developed suspicion for wooden chest syndrome (WCS) and discontinued fentanyl
- Hypoxia improved within 36 hrs but plateau pressures consistently >30 cm H2O despite minimizing dead space

### Outcome
- Pplat nadired at 16 within one hour after stopping fentanyl
- Pt successfully extubated on VD 10

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**Compliance is Inverse to Transpulmonary Pressure**

\[ c = \frac{\Delta v}{\Delta p} = \frac{\Delta v}{p_{av} - p_{pl}} \]

- \( c \) = lung compliance
- \( \Delta v \) = volume
- \( \Delta p \) = alveolar pressure
- \( p_{av} \) = alveolar pressure
- \( p_{pl} \) = pleural pressure

**Poor Compliance in both ARDS and WCS**

<table>
<thead>
<tr>
<th></th>
<th>COVID-19 ARDS</th>
<th>Wooden Chest Syndrome</th>
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<tbody>
<tr>
<td>Plateau pressure</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Lung compliance</td>
<td>Low</td>
<td>Low</td>
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<tr>
<td>Alveolar pressure</td>
<td>High</td>
<td>Low</td>
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<tr>
<td>Pleural pressure</td>
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**Fentanyl Activates Muscles**

Fentanyl uniquely activates laryngeal and respiratory muscle potentially leading to a fatal syndrome known as Wooden Chest Syndrome (WCS) manifested by poor ventilation

- It is likely more common than clinicians realize

**Likely Prevalence**

- Frequency of Opiates Used in ICU
  - Morphine & analogues
  - Fentanyl & analogues

- Fentanyl is the most used analgesic in ICU patients on mechanical ventilation

- 99%* of people develop at least mild muscle rigidity when given fentanyl

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**Takeaway Points**

- Maintain a high index of suspicion for alternate or overlying physiologies when treating persistent ventilatory failure in ARDS
- It is likely more common than clinicians realize

- Discontinue fentanyl if lung compliance and ventilatory failure seem out of proportion to hypoxia

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**References**