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INSIGHTS
Your Simple Path to Medical Findings

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Insights into Prehospital Mechanical Ventilation of Trauma Patients

1 Introcuction

Trauma care in the prehospital setting is considered a critical part of the emergency medical services (EMS). Proper management of traumatically injured patients, particularly those requiring mechanical ventilation, demands a comprehensive understanding of injury-specific considerations and recommended ventilation strategies. The following are key insights from the "Prehospital Mechanical Ventilation: An NAEMSP Position Statement and Resource Document" (Baez et al, 2022) to provide EMS providers with some essential highlights for managing ventilation in trauma patients during transport to enhance patient outcomes.

2 TRAUMA

2.1 Considerations for Mechanical Ventilation

Traumatically injured patients do not always require invasive mechanical ventilation. The decision to use mechanical ventilation should be based on the assessment of the injury's severity, anatomical and physiological impacts, the patient's hemodynamic stability, transport logistics, and the distance to in-hospital care.

2.2 Pathophysiology

The primary pathologic process in trauma is hemorrhage, which leads to progressive anaerobic metabolism, metabolic acidosis, and elevated lactic acid levels. Mechanical ventilation may be indicated to support increased oxygen demand or to reduce the work of breathing in severely injured patients.

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2.3 Practical Considerations

- Continuous monitoring of oxygen saturation (SpO2) and end-tidal CO2 (EtCO2) is essential to ensure adequate oxygenation and ventilation.
- Mechanical ventilation should be used to stabilize the patient during prolonged transport, ensuring consistent ventilation support.

2.4 Management Strategies:

1. Hemorrhage Control and Volume Resuscitation:

- Before initiating mechanical ventilation, appropriate external hemorrhage control and volume resuscitation must be addressed to compensate for the reduction in preload caused by positive pressure ventilation. Positive pressure ventilation increases intrathoracic pressure, which reduces venous return to the heart, impacting cardiovascular function.

2. Minute Ventilation:

- MV (respiratory rate x tidal volume) should be adjusted to address the patient's metabolic acidosis.
- The ventilator should be set to meet or exceed the pre-intubation respiratory rate to ensure adequate ventilation to manage the acidosis and maintain respiratory function.

3. Lung-Protective Strategy:

- Severe traumatic injury is a risk factor for acute respiratory distress syndrome (ARDS). Therefore, using a lung-protective strategy at the beginning of the ventilation may improve patient outcomes and reduce the risk of ventilator-induced lung injury.
- Titrate Tidal Volume (Vt) as low as 6-8 mL/kg of predicted body weight.

4. Oxygen Saturations:

- Maintain oxygen saturation at 94-98%.

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3 Airway and Chest Trauma

3.1 Rib Fractures and Pulmonary Contusions

Rib fractures, along with any associated pulmonary contusion, can significantly compromise ventilation and oxygenation, particularly in elderly trauma patients.

1. **Assessment and Management:** Be alert for multiple rib fractures in elderly patients even after low-impact injuries and consider the multiple rib fractures in all age groups after high-impact trauma.

2. **Invasive Mechanical Ventilation:** Consider invasive mechanical ventilation if there is a persistent increase in work of breathing or hypoxemia despite adequate analgesia and non-invasive oxygen therapy, especially if transport times are prolonged.

3. **Ventilation Strategy:** Adopting a higher PEEP strategy can help recruit alveoli and reduce shunting while being mindful of any preexisting lung pathology that may affect the ventilation strategy.

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3.2 Pneumothorax

Pneumothorax is a potential complication in trauma patients and requires active monitoring.

1. **Active Monitoring:** A mild or moderate pneumothorax can become clinically significant when invasive mechanical ventilation is initiated or continued during transport.

2. **Decompression:** Follow local guidelines for pneumothorax decompression. Recent evidence supports that decompression at the fifth intercostal space, anterior axillary line, is more successful than the traditional second intercostal space, midclavicular line.

3.2 Tracheobronchial Disruption

1. **Diagnosis:** Tracheobronchial disruption is a rare condition that can be suspected in situations of worsening respiratory distress with positive pressure ventilation, the presence of blood in the endotracheal tube, or severe subcutaneous emphysema.

2. **Management:** These injuries often occur within 2 cm of the carina. In such cases, consider carefully advancing the endotracheal tube into the right mainstem bronchus to get beyond the injury may help bypass the injury and improve ventilation.

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4 Neurologic Emergencies Affecting the Brain

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4.1 Prevention of Secondary Brain Injury

1. **Minimizing Secondary Injury:** Intubation and mechanical ventilation in neurologic emergencies (such as cerebrovascular accidents, intracranial hemorrhages, and traumatic brain injuries) are crucial to prevent secondary brain injury.

2. **Avoiding Hypoxia and CO2 Imbalance:** Both hypoxia and abnormal levels of CO2 (either hypercapnia or hypocapnia) can be harmful to cerebral blood flow and intracranial pressure (ICP).

4.2 Decision to Intubate

The decision to intubate should not be based only on a Glasgow Coma Scale score of <8, consider the expected clinical course, duration and llogistics of transport, signs or symptoms of elevated ICP, and the presence or absence of airway reflexes.

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4.3 Management During Transport

1. **Maintenance of Oxygen Saturations:**
   - Maintain normal oxygen saturations, typically between 94-98%.
2. **Minute Ventilation:**
   - Adjust minute ventilation to avoid hypo- and hypercapnia.
   - When using end-tidal CO2 monitoring, it is important to remember that the PaCO2-EtCO2 difference is 2-5 mmHg due to alveolar dead space. Therefore, a low-normal CO2 value should be targeted, typically between 35-40 mmHg.
3. **Avoiding Hyperventilation:**
   - Do not hyperventilate except as a temporary measure to manage uncontrolled elevated ICP.

4.4 Hemodynamic Considerations

1. **Preventing Hypotension:** The decision to intubate should not be based only on a Glasgow Coma Scale score of <8, consider the expected clinical course, duration and logistics of transport, signs or symptoms of elevated ICP, and the presence or absence of airway reflexes.
2. **Sedation and Agitation Management:** Administer appropriate sedation to manage hypertension caused by agitation, which can increase ICP.
3. **Positioning:** If feasible, position the patient with the head-of-bed raised to 30 degrees to assist in managing ICP.

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REFERENCES

The insights presented on this topic are derived from the following article. For a comprehensive review and more detailed information on this topic, please refer to the original text:

Baez, A. A., Qasim, Z., Wilcox, S., Weir, W. B., Loeffler, P., Golden, B. M., … Levy, M. (2022). Prehospital Mechanical Ventilation: An NAEMSP Position Statement and Resource Document. Prehospital Emergency Care, 26(sup1), 88–95. https://doi.org/10.1080/10903127.2021.1994676

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