Ventilation - Mechanical Brain Injury Notes

Etiology

Classification

1. Traumatic head injury with alteration in GCS
2. Suspected brain injury due to a non-traumatic condition (e.g. disruption in cerebral blood flow, prolonged hypoxia)

Patient Safety Considerations

- Calculate O₂ consumption prior to transporting patient on ventilator

Interventions

Application

1. The primary goal is to keep these patients oxygenated
2. Set the initial ventilator rate at 16 breaths per minute
3. Initiate ventilation using a low tidal volume strategy 8 mL/kg ideal body weight
4. A secondary goal may be to achieve an arterial CO₂ of 32 - 35 mmHg
   a. PEEP can decrease blood pressure and cerebral perfusion
   b. Despite the hemodynamic effects, PEEP may be necessary in a hypoxemic patient with diffuse lung injury
      i. Consult TP to discuss management of this difficult scenario
      ii. Blood pressure support with volume and vasopressors may be indicated
5. Elevated intracranial pressure is a relative contraindication to PEEP
6. Whenever possible place the patient in reverse Trendelenburg position

Adjustments

1. Initial goal is an EtCO₂ of 33 mmHg or less
2. If arterial blood gas level is available, the goal is an arterial CO₂ of 35 - 40 mmHg
3. Alternatively, the venous CO₂ goal is 40 mmHg or greater
4. In healthy patients, venous CO₂ generally reads 5 mmHg higher than arterial CO₂. This difference will be greater in patients with poor peripheral perfusion
   a. In most cases, AMC will be limited to EtCO₂ and venous CO₂
   b. If the EtCO₂ is 33 mmHg or lower and the venous CO₂ is 40 mmHg or greater, then arterial CO₂ is likely between these numbers
5. In cases where the EtCO₂ is lower than expected, and the venous CO₂ is higher than expected, consider maintaining the initial ventilator settings as neither may be a good reflection of the arterial CO₂.

Special Circumstances

Herniation Syndrome

Patient Safety Considerations

- The application of a hyperventilation strategy may be detrimental to patients with a significant head injury but no herniation syndrome.
- Hyperventilation should only be used as a temporizing measure while hyperosmolar agents are prepared.
- **Consult TP** to consider this strategy only when GCS less than 8 and one or more of the following:
  - Abnormal pupils (fixed / dilated, non-reactive, either bilateral or unilateral)
  - Abnormal motor exam (posturing)

1. Herniation syndrome is often caused by trauma and the associated bleeding and swelling, but it may also be caused by spontaneous bleeding, infection, or the growth of a tumor.

2. Identification of herniation syndrome in the prehospital environment relies on physical examination findings. These include a GCS less than 8 and one or more of the following:
   a. Abnormal pupils (both pupils fixed and non-reactive or, one or both pupils dilated)
   b. Abnormal motor exam (flaccidity or posturing)

3. Cushing’s triad is thought to be too non-specific to be used as inclusion criteria for herniation syndrome.

4. If a hyperventilation strategy is initiated, the CO₂ goals should be
   a. Arterial CO₂ of 32 - 35 mmHg
   b. Venous CO₂ of 35 mmHg or greater
   c. EtCO₂ of 30 mmHg or less

5. In cases where the EtCO₂ is lower than expected, and the venous CO₂ is higher than expected, consider maintaining the initial ventilator settings as neither may be a good reflection of the arterial CO₂.

Pharmacology

Not applicable
Appendix

Insert Ideal Body Weight Male / Female Tables here