


**FERNE / MEMC IV Brain Illness and Injury Course:  
Evaluation & Management of  
Severe Traumatic Brain Injury Patients with Suspected Elevated ICP  
Michelle Biros, MD, FACEP**

**Evaluation & Management  
of Severe Traumatic  
Brain Injury Patients  
with Suspected  
Elevated ICP**

Michelle Biros, MD 

  
Foundation for Education and Research  
in Neurological Emergencies

***FERNE Brain Illness  
and Injury Course***

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The Fourth  
Mediterranean Brain Injury Alliance Congress (MEMC IV)  
Sorrento, Italy  
15-19 September 2007

**4<sup>th</sup> Mediterranean  
Emergency Medicine  
Congress  
Sorrento, Italy  
September 17, 2007**

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**Objectives**

- Discuss key concepts in ED management of severe TBI
- Review the 2007 Brain Trauma Foundation (BTF) recommendations on acute management of elevated ICP

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**Severe TBI: Case Presentation**

- 18 year old, struck on head
- Agitated at the scene
- GCS score = 8
- En route, decompensates
- On ED arrival, decerebrate posturing

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## **Key Clinical Questions**

What are key considerations for the ED management severe TBI?

Who is at risk for elevated ICP?

What is appropriate ED management of apparent elevated ICP?

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## **Blood Pressure**

What is known

- One episode of SBP < 90 mm increases morbidity and doubles mortality
- Repeated episodes increase risk
- Correcting BP is associated with improved outcomes

What is not known

- Best target values

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## **Oxygenation**

What is known

- Desaturation occurs often in HT and during intubation
- A single episode of hypoxia worsens morbidity and mortality

What is not known

- Level of hypoxia that correlates with poor outcome

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## **BP and Oxygenation**

2007 BTF Recommendations

Level II- BP should be monitored and hypotension ( SBP < 90 mm) avoided

Level III- oxygenation should be monitored and hypoxia (  $paO_2$  < 60 mm ) avoided

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## **Who is at risk for elevated ICP?**

2007 BTF on ICP monitoring

Level II

- Severe TBI ( GCS Score 3-8 after resuscitation), and abnormal CT scan

Level III

- Normal CT and two or more –
  - Age >40; motor posturing; SBP < 90mm

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## **Emergent Management of ICP**

Hyperosmolar Agents

- Mannitol
- Hypertonic saline

Hyperventilation

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## **Mannitol**

Has beneficial effects on ICP, CCP and brain metabolism

- Two possible mechanisms
  - Immediate plasma volume expansion
  - Delayed osmotic effects

Risky in certain patients

- Hypotension, sepsis, renal disease

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## **Hypertonic Saline**

Many possible benefits

- May create an osmotic gradient across the intact BBB, reducing cerebral water content
- Dehydrates endothelial cells, thus increasing vessel diameter
- Expands plasma volume

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## **Hypertonic Saline**

1.6-10%; case series or small studies

Some possible adverse events

- Central Pontine Myelinolysis if previous hyponatremia
- Hypernatremia and hyperosmolality
- Pulmonary edema if preexisting cardiac/ pulmonary disease

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## **Hyperventilation**

What is known

- Reduces ICP by vasoconstriction and subsequent reduced CBF
- CBF is already reduced in TBI
- If too aggressive, may cause cerebral ischemia

What is not known

Does short term hyperventilation change outcome?

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## **Emergent ICP Management**

2007 BTF Recommendations

Level II- Mannitol ( 0.25-1.0 gr/kg) is effective in reducing elevated ICP

- Avoid arterial hypotension

Level III- Use mannitol only for herniation or progressive deterioration

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## **Emergent ICP Management**

Level II

- Prophylactic hyperventilation not recommended

Level III

- Use only as a temporizing measure
- If possible, avoid in first 24 hours
- Monitor O<sub>2</sub> delivery with S<sub>j</sub>O<sub>2</sub> or P<sub>br</sub>O<sub>2</sub>

Current evidence not strong enough for recommendations on HTS

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## **Seizure Prophylaxis**

What is known;

Seizures may precipitate adverse events

- increase ICP, BP, neurotransmitters
- decrease BP, oxygen delivery

Patients at risk

- GCS Score < 10
- Contusions, SDH, EDH, ICH
- Depressed skull fracture, penetrating HT
- Seizure within 24 hrs of injury

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## **Seizure Prophylaxis**

2007 BTF Recommendations

Level II

Prophylactic anticonvulsants not recommended to prevent late Sz

Level III

Anticonvulsants are indicated to prevent early post-trauma seizures

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## **Key Learning Points**

- Avoid hypotension and hypoxia in patients with severe TBI
- Acute interventions to reduce ICP should occur in cases of herniation or acute deterioration

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## **Questions?**

[www.FERNE.org](http://www.FERNE.org)

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9/27/2007 11:16 AM

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