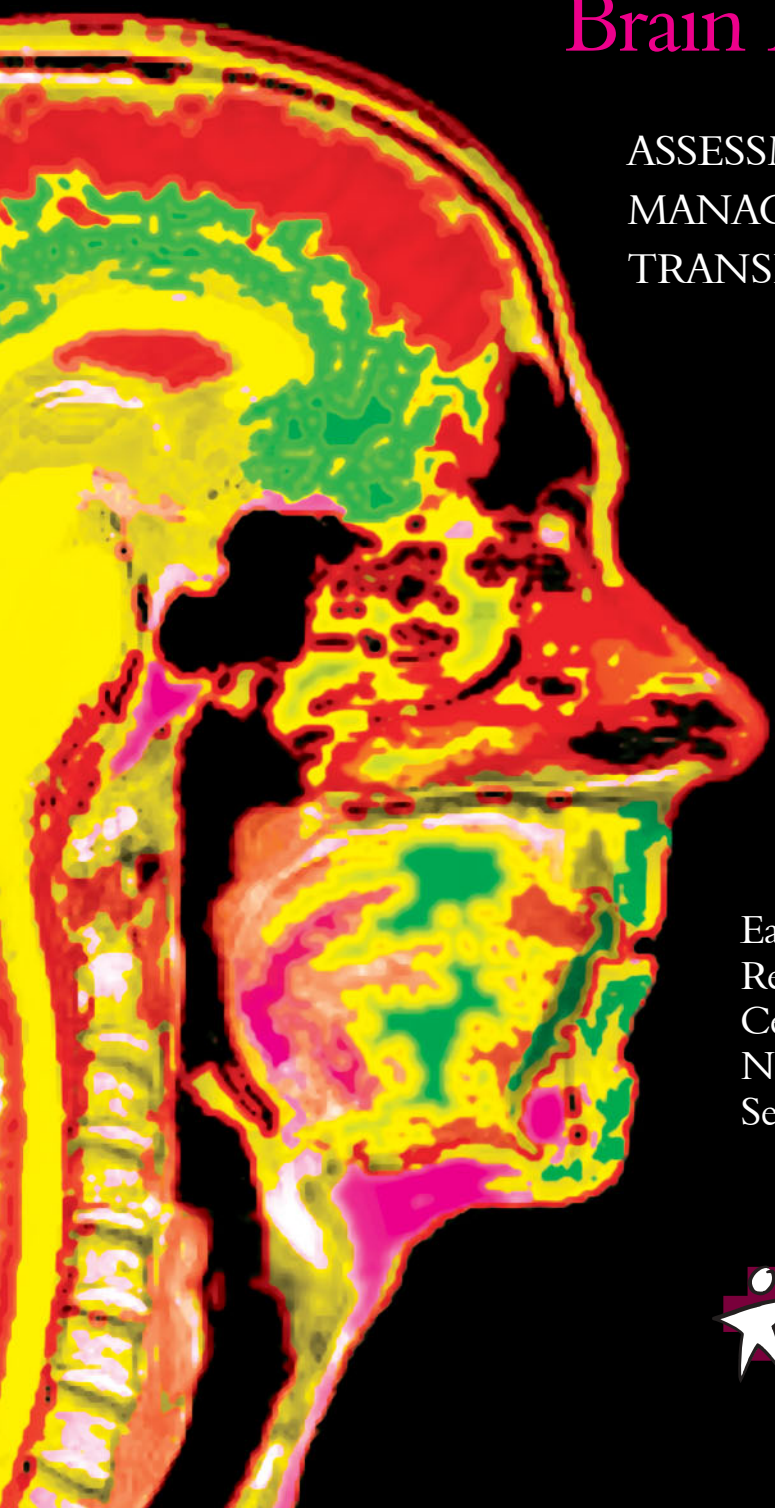
Guideline for Management of Traumatic Brain Injury

ASSESSMENT
MANAGEMENT
TRANSPORTATION



Eastern Idaho
Regional Medical
Center
Neurological
Services

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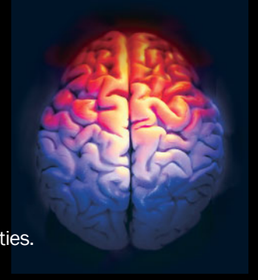
Traumatic Brain Injury (TBI)



There are approximately 1.6 million head injuries in the United States each year. Traumatic brain injury (TBI) is the leading cause of death and disability in children and young adults.

Approximately 60,000 people a year die from TBI, and 70,000-90,000 are left with permanent neurological disabilities.

Secondary Brain Injury

Secondary brain injury is brain cell death due to lack of oxygen and blood flow to the brain (ischemia). It occurs most often in TBI comatose patients. Secondary brain injury evolves over time after the primary brain injury, increasing mortality and worsening disability.

Receiving Hospital

The receiving hospital for severe TBI patients should have immediate diagnostic and interventional capability, and should be compliant with the *Guidelines for the Management of Severe Head Injury*.

EMS personnel should use these guidelines to assess the presence and degree of traumatic brain injury, and to make decisions regarding appropriate stabilization, initial treatment, and transportation.

Priorities

- Assessment / Treatment
  - Airway
  - Breathing
  - Circulation
  - Cervical Spine
  - Disability
  - Exposure

TBI Assessment

- TBI assessment always follows the ABC's of assessment and treatment.
- Identifying TBI in the prehospital setting is critical.
- The determination of TBI impacts assessment, treatment and transport decisions.

Oxygenation

- Early post-injury episodes of hypoxemia greatly increases mortality and morbidity.
- Evidence defines hypoxemia as apnea or cyanosis in the field or an oxygen saturation (SaO_2) < 90%.
- Intubation of the unconscious and unresponsive TBI patient improves outcome.
  - Provide supplemental O2
  - Keep SaO_2 saturation > 90%
  - If available intubate patients with:
    - Persistent hypoxemia (SaO_2 < 90%) with oxygen
    - Apnea
    - Airway compromise
  - Monitor SaO_2 continuously
    - Unconsciousness (comatose) or unresponsiveness with a (GCS < 9)

Blood Pressure

- Evidence defines hypotension as a single observation of SBP < 90mm Hg (in adults).
- A single episode of hypotension doubles mortality and increases morbidity.
- Evidence suggests that raising blood pressure in hypotensive patients with TBI improves outcome.
- Blood pressure
  - Monitor Q 5 min
  - Prevent hypotension
  - Administer isotonic fluid to reverse hypotension (SBP <90 mmHg)
- Pediatric SBP is considered hypotension by age groups:
  - <65 mmHg (0-1 year)
  - <75 mmHg (1-5 years)
  - <80 mmHg (5-12 years)
  - <90 mmHg (>12 years)

Glasgow Coma Scale

Eye Opening

Spontaneous	4
To Speech	3
To Pain	2
None	1

Motor Responses

Obeys commands	6
Localizes	5
Withdraws	4
Abnormal flexion	3
Extension	2
None	1

Verbal Response

Oriented	5
Confused	4
Inappropriate	3
Incomprehensible	2
None	1

Total ..... (3-15)

- Perform after resuscitation & before administering sedatives or paralytics
  - 14-15 Mild TBI
  - 9-13 Moderate TBI
  - 3-8 Severe TBI
  - Serial examinations
  - Change in GCS > 2 is a significant prognosticator

Glasgow Coma Scale

Motor Exam

- **6** – Follows commands
- **5** – Localizes to axillary pinch
- **4** – Withdrawal to nailbed pressure
- **3** – Flexor to nailbed pressure (decorticate)
- **2** – Extension to nailbed pressure (decerebrate)
- **1** – Flaccid to nailbed pressure

Pupils

- The initial pupil exam, with the GCS score establishes a neurological baseline.
- The pupil exam in conjunction with the GCS score aids in determining treatment.
- The pupillary exam should be performed:
  - after resuscitation
  - before administration of sedatives or paralytics

Pupillary Exam

- Pupil reactivity to light
  - positive reaction > 1mm constriction
- Pupil asymmetry
  - significant asymmetry > 1mm difference
- Fixed/Dilated Pupils
  - pupils that are ≥ 4mm and react < 1mm

Signs of Cerebral Herniation

In an unconscious and unresponsive patient:

- Patient with dilated and unreactive pupil(s)
- Patient with asymmetric pupils
- Patient non-responsive to painful stimuli
- Patient displaying extensor posturing

Hyperventilation

- In severe TBI patients, the following are signs of cerebral herniation:
  - Asymmetric pupils (size > 1mm difference)
  - Pupils fixed & dilated (≥4 mm)
  - GCS Motor
    - 1 Flaccid
    - 2 Extension (decerebrate posturing)
- Requires emergency intervention, i.e. hyperventilation, to lower intracranial pressure

Ventilation Parameters

- Normal ventilation rates are defined as approximately:
  - 10 breaths per minute (bpm) for adults
  - 20 bpm for children
  - 25 bpm for infants
- Hyperventilation is defined as approximately:
  - 20 breaths per minute (bpm) for adults
  - 30 bpm for children
  - 35 bpm for infants

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Call (208) 227-2000

Transport Decisions

Minimum facility requirements:

Mild TBI

- GCS 14, 15

Transport to Emergency Department

Moderate TBI

- GCS 9-13

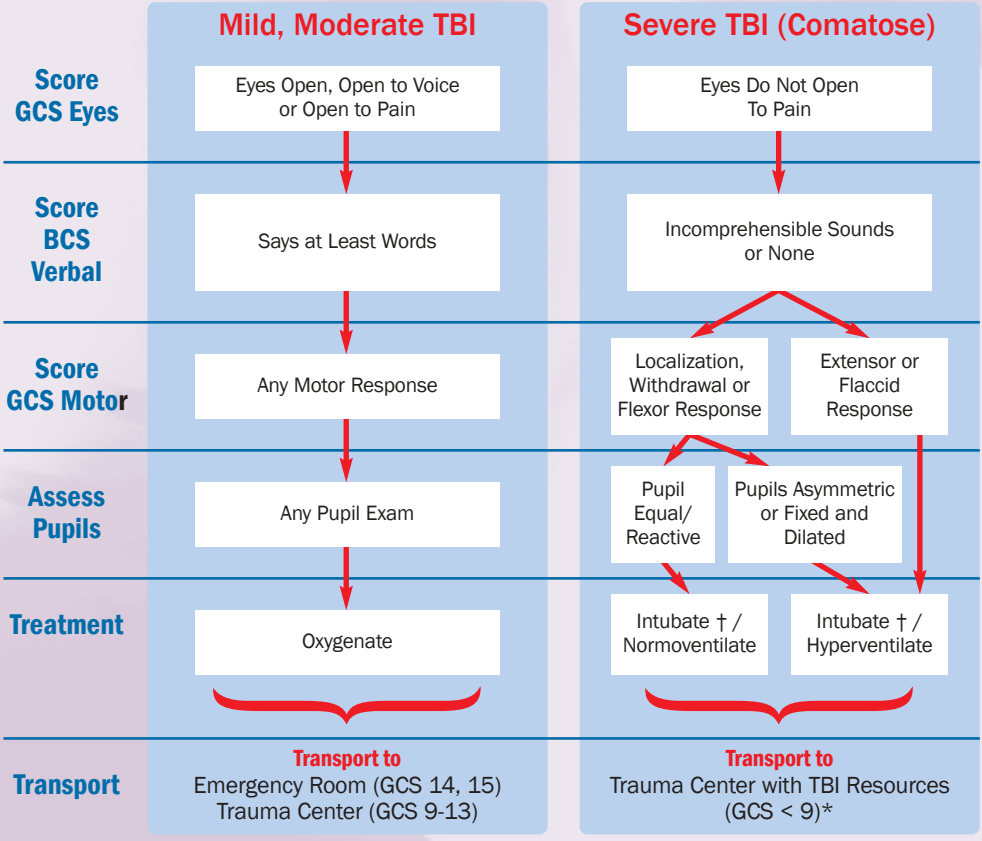
Transport to Trauma Center

Severe TBI GCS 3-8

Transport to Trauma Center with the following capabilities:

- 24 hour CT scan availability
- 24 hour operating room availability
- Prompt neurosurgical care
- Ability to monitor intracranial pressure
- Ability to treat intracranial hypertension as delineated in the Guidelines for the Management of Severe Head Injury

Triage for The TBI Patient



First Priority	Keep
Airway	‡ SBP >90 mm Hg
Breathing	MAP >90 mm Hg
Circulation	SaO_2 >90%

† Ventilate and oxygenate if intubation not available

* Trauma Center with 24-hour scanning capability, 24-hour available operating room, prompt neurosurgical care and the ability to monitor intercranial pressure and treat intracranial hypertension as delineated in the **Guidelines for the Management of Severe Head Injury (www.braintrauma.org)**

‡ See table for pediatric values

Neurologic Services

Diagnostics and Management (208-227-2600)

- Spinal cord injuries
- Tumors of the brain and spine
- Traumatic brain injuries
- Spine deformities
- Aneurysms
- Stroke and hemorrhages
- Multiple Sclerosis
- Epilepsy
- Parkinson's Disease
- ALS
- Severe or recurrent headaches
- Dementia/Alzheimer's
- Spine and extremity pain
- Muscle disorders

Therapeutics (208-227-2600)

- Lumbar/cervical
- Peripheral nerve
- Stereotactic procedures

Trauma Management (208-529-7830)

- Intracranial pressure monitoring
- Sedation
- Ventilation
- Air beds
- Swan-Ganz and arterial pressure catheters
- Brain tissue oxygen monitoring

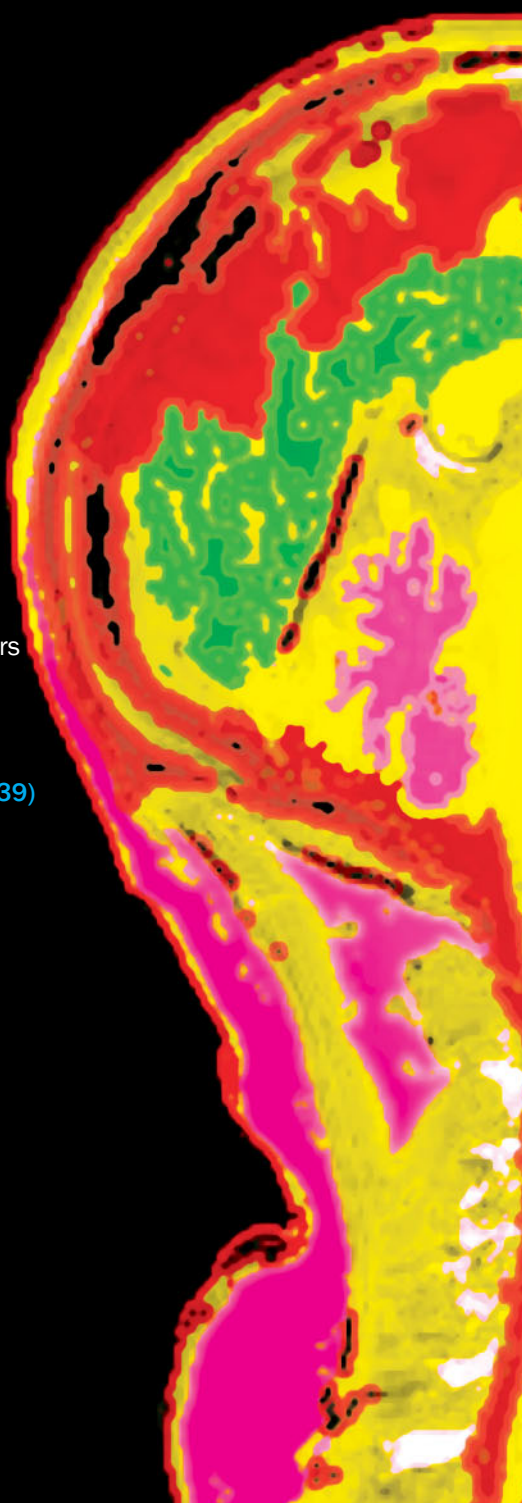
Stroke Care (208-227-2000)

Sleep Disorder Treatment (208-529-6139)

Acute Inpatient Rehab (208-529-7660)

Outpatient Rehab (208-529-7999)

Transfer Coordination Center
(208-529-6340 or 800-247-4324)



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