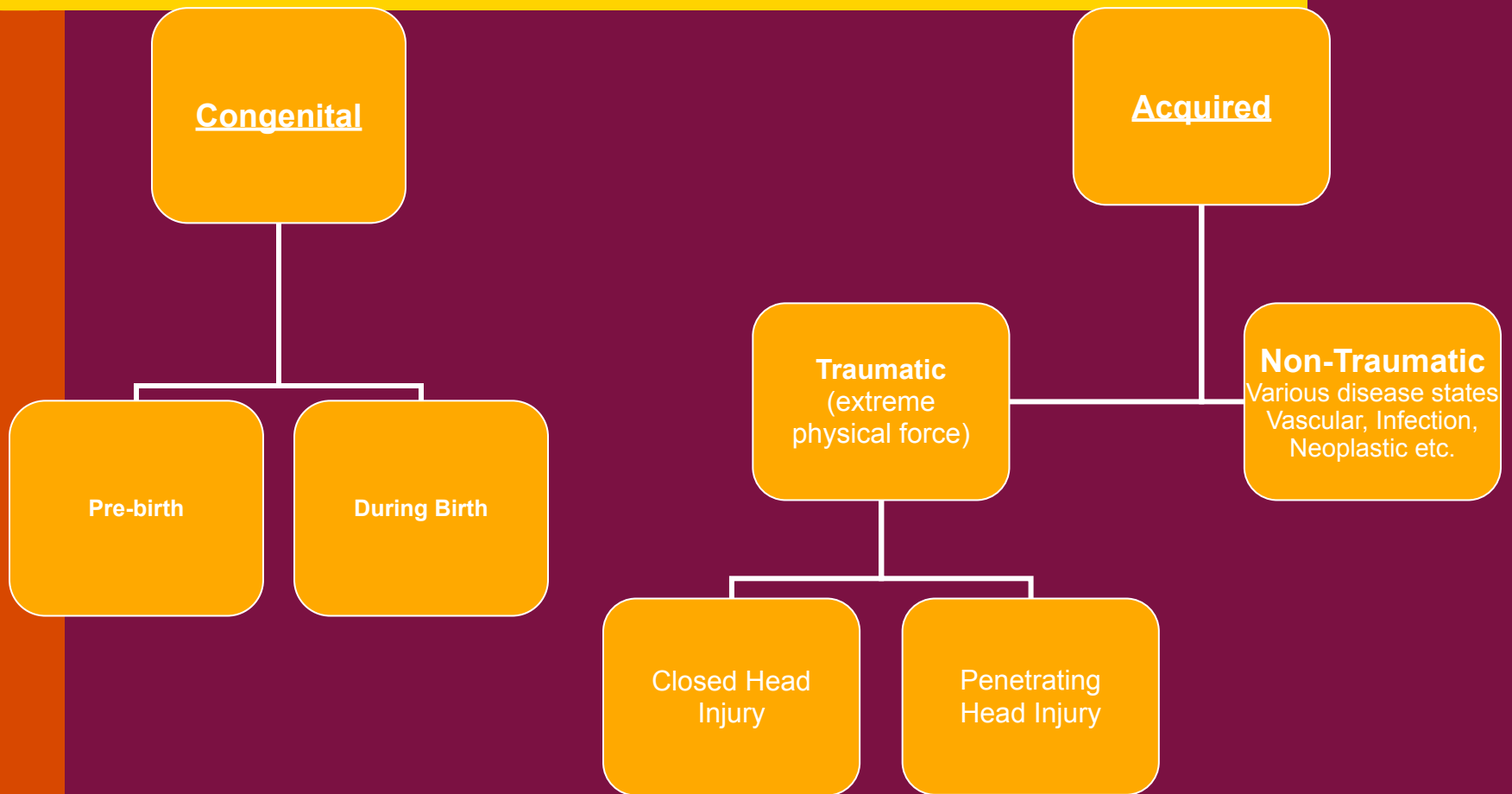


Concussion/ Post concussion Syndrome/ Second Impact syndrome

Michael E. Jones D.O.



Brain Injuries



Head Injury

“Any alteration in mental or physical functioning related to a blow to the head”

Loss of consciousness does not need to occur

TBI Statistical Analysis

- 600,00 new TBI's occur annually in the U.S
- As many as 10% are fatal
- 75-80% categorized as mild
- 550,00 hospitalized annually

Statistics

- 100,00 per year will suffer permanent disability.
- Men are nearly twice as likely to be hospitalized with brain injury than are women.
- Approximately half of those hospitalized with a head injury are age 24 or younger.

Pathophysiology

- **Two Types of TBI's**
 - Open Head Injury (Penetrating)
 - Skull Fracture
 - Bullet Wound
 - Closed Head Injury
 - Acceleration/Deceleration Phenomenon
 - Contusion
 - **Coup/Contrecoup**
 - Diffuse **axonal** injury

Clinical Parameters

- Concussion
 - Traumatic injury to the brain resulting in alteration of mental status.
 - With or without LOC
 - Stretching/Shearing forces/rotational forces/ARAS
- Clinical Observations
 - Neurobehavioral
 - Blank stare, delayed motor, verbal responses, impaired comprehension
 - Inattentiveness, disorientation, walking in wrong direction
 - Speech alterations, incomprehensible, inappropriate
 - Memory difficulty, repeating

Clinical Parameters

- Somatic Symptoms:
 - Nausea, vomiting
 - Headache
 - Ataxia, stumbling
 - Nystagmus

Clinical Parameters

- Psychosocial symptoms
 - Emotional disturbances/ mood disorders
 - Personal changes
 - Irritability, giddiness
 - Loss of libido

Clinical Grading Systems

- Glasgow Coma Scale

Score

Eye Opening

4

Spontaneously

3

To verbal command

2

To pain

1

No response

Glasgow Coma Scale

<u>Score</u>	<u>Best Motor Response</u>
6	Obeys command
5	Vocalizes pain
4	Flexion withdrawal
3	Flexion abnormal (decorticate)
2	Extension (decerebrate)
1	No response

Glasgow Coma Scale

Score

5

4

3

2

1

Best Verbal Response

Oriented and converses

Disoriented and converses

Inappropriate words; cries

Incomprehensible sounds

No response

Glasgow Coma Scale Score

Score

GCS= 14-15 Mild

GCS= 9-13 Moderate

GCS= <8 Severe

Concussion Grading

- Glasgow Scale too insensitive to minor brain injuries.
- AAN System
 - Mild (Grade 1)
 1. Transient confusion
 2. No LOC
 3. Symptoms resolve in < 15 min.
 - Moderate (Grade 2)
 - As above but symptoms last >15 min.
 - Severe (Grade 3)
 - Any LOC whether brief or prolonged

Concussion Grading

- Cantu System
 - Mild (Grade 1)
 - PTA < 30 min.
 - No LOC
 - Moderate (Grade 2)
 - LOC < 5 mins, or PTA > 30 mins
 - Severe (Grade 3)
 - LOC > 5mins, or PTA > 24 hours

Concussion Grading

- Despite use of and reliance upon concussion severity scales, they correlate poorly with presence and duration of test impairment.

Return to Play Guidelines

- Single sports related event
 - Mild Concussion
 - Remove from play
 - Q 5 min. assessments for amnesia, post concussion symptoms
 - May return to play if symptoms resolve within 15 min.

Return to Play Guidelines

- Moderate Concussion
 - Remove from contest
 - Disallow return that day
 - Frequent on site assessments for evolving intracranial pathology
 - Re-examine next day by trained professional
 - Neuroimaging if headache or other sx last > 1 week.
 - Return to practice after 1 week of symptom resolution

Return to Play Guidelines

- Severe Concussion
 - ED Evaluation
 - Emergent neuro exam
 - Neuro-imaging?
 - Hospital admit?
 - Persistent symptoms, prolonged LOC, abnormal neurologic exam.
 - Home with head injury instructions

Criteria for Home Observation

- CT normal
- Initial GCS > 14
- Pt. now neurologically intact
- Reliable guardian to observe patient
- Pt. has reasonable access to return to ED
- No “complicating factors” (suspicions of domestic violence, child abuse etc.)

Home Instructions

- Seek medical attention for any of the following:
 - Change in LOC, difficulty arousing from sleep
 - Abnormal behavior
 - Increased headache
 - Slurred speech
 - Focal weakness, or paresthesia
 - Persistent vomiting

Home Instructions

- Pupillary asymmetry
- Seizures
- Significant increase in swelling at injury site
- No sedatives or pain meds other than acetaminophen for 24 hours. No ASA or anti-inflammatory meds.

Return to play guidelines

- Severe concussion
 - Brief (< 1 min) grade 3 concussion, no return to practice until asymptomatic for 1 full week.
 - After prolonged (> 1 min) grade 3 concussion must be sx free for 2 weeks prior to return to practice.

Recommendations for multiple sports-related concussions in the same season

<u>Concussion No.</u>	<u>Severity</u>	<u>Guidelines to be met before return to competition</u>
2	Mild	1 Week
	Moderate	1 Month +normal CT or MRI
3	Mild	Most consider this a season ending injury and recommend CT or MRI
	Moderate	
2	Severe	Season ending injury, consideration for ending all participating in contact sports

Clinical Assessment

- Neuroimaging
 - CT
 - Imaging modality of choice
 - Rapid acquisition time
 - Widely available
 - Easy to interpret
 - Reliable

Clinical Assessment/ Imaging Criteria

- Any LOC
- Abnormal head CT despite initial GCS 15 more likely if:
 - Age > 60
 - Headaches
 - Vomiting
 - Memory Problems
 - Trauma above clavicles
 - Seizures
 - Clinical decline
 - Normal CT and GCS of 15 does not preclude brain trauma (DAI)

Post Concussion Syndrome

- Controversial, poorly understood, poorly defined
- No universally accepted definition established
- Generally defined as sequale following minor head injury with development of at least 3 of the following symptoms.
 - Headache most common sx, dizziness 2nd most common sx, fatigue, irritability etc.
 - Impaired memory, concentration, insomnia
 - Confusion as to latency and duration of symptoms.

Post concussion Syndrome

- Absence objective neurologic findings
 - Organic or Psychological
 - Hypothesized that early post concussion symptoms are more likely to be organic.
 - Post concussion symptoms that persist beyond three months more likely to be nonorganic.
 - Advanced MRI techniques, SPECT, magnetoencephalography have demonstrated organic brain injury in some patients with post concussive symptoms > 1 year.

Statistics

- More than 1 million minor head injuries annually in US.
- 50% of patients with minor head injuries have symptoms of post concussive syndrome after 1 month.
- 15% still symptomatic at 1 year.
- More likely to have minor head injury
- Incidence of post concussive syndrome is greater in women.
- No predilection for age

Associated Risks

- Increased risk if LOC occurs
- Amnesia
- Abnormal Neuro behavioral testing.
- Secondary Gain-conflicting opinions.
- Pre-morbid mood/personality disorders-conflicting options.
- Female sex
- Risk 4-5 times > in the event of 1 previous concussion

Differential Diagnosis

- Epidural Hematoma – initial LOC, lucid interval
- Subdural Hematoma- mostly in elderly individuals, rarely in the athlete
- SAH
- SIS
- Intraparenchymal Hemorrhage/ Contusion
- LOC, persistent worsening of symptoms, abnormal neurologic exam, convulsions

Second Impact Syndrome

- Rare condition, seen in athletes sustaining a second concussion while still symptomatic from previous injury
- May occur days to weeks from first injury
- Malignant cerebral edema results, refractory to treatment.
- Death occurs within minutes
- Only 17 cases confirmed-controversial
- True risk/pathophysiology poorly understood

Treatment

- Beyond the initial assessment focuses primarily on management of pain and other SX.
- ASA, Acetaminophen, OTC's
- Avoid narcotics which may cloud mental status and compromise neurologic exam

Prognosis

- 50% of individuals still have sx of PCS after 1 month
- 15% continue to have difficulty beyond 1 year.
 - In this group, symptoms may pose lifelong disability.

References

1. Head Injury David Olson M.D.
2. Thomas KE, Stevens JA, Sarmiento K, Walt MM. Full-related traumatic brain injury deaths and hospitalizations among older adults- United States, 2005. J safety Res. 2008, 39 (3): 26992
3. Epilepsy After Brain Insult Neurology 2002; 59; 521-526.
Susan T. Herman M.D.
4. Post concussive Syndrome Eric Legome, M.D. Chair Dept. of Emergency Medicine, St. Vincent's Hospital, Manhattan.
5. Second Impact Syndrome, Neurology 1998; 50; 677-683.
Paul R. McCrory, FRACP, FACSM and Samuel F. Berkovic, MD, FRACP.

References

6. Nabeel Konda, M.D., D.O., MBA, Traumatic Brain Injury
7. Handbook of Neurology 6th Edition, Marks. Greenburg.
8. Concussion: The history of clinical and pathological concepts and misconceptions. Paul R. McCrory, PhD FRACP and Samuel F. Berkovic, M.d. FRACP. Neurology 2001; 59; 2283-2289.
9. Video analysis of acute motor and convulsive manifestations in sport-related concussion. Neurology 2000; 54; 1488-1491. Paul McCrory, M.D. FRACP and Samuel F Berkovic, M.D., FRACP.

References

10. AAN clinical practice guidelines, *Neurology* 2002; 58; 975-976.
11. Diffusion tensor imaging of acute mild traumatic brain injury in adolescents. *Neurology* 2008; 70; 948-955 E.A. Wilde, PhD, et al.
12. Oligodendrocytes: Susceptibility to injury and involvement with neurologic disease.