

**TRAUMATIC BRAIN INJURY
EVALUATION:
TOOLS, REHAB, & TREATMENT**

OGDEN SURGICAL-MEDICAL SOCIETY
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CLINICAL NEUROPSYCHOLOGY
BRAIN INJURY CLINIC AT TANNER

DISCLOSURES

- No relevant disclosures financial or otherwise are associated with this presentation

PROFESSIONAL AFFILIATIONS

- American Psychological Association
- Utah Psychological Association
- National Academy of Neuropsychology
- American Academy of Clinical Neuropsychology
- International Neuropsychological Society
- International Brain Injury Association
- International Paediatric Brain Injury Association
- Sports Neuropsychology Society
- Medical Staff
 - Davis Hospital & Medical Center
 - McKay Dee Hospital
 - Ogden Regional Medical Center

OBJECTIVES:

- A review of current research, practice and protocol
- Completing a thorough Initial Assessment and implementing an appropriate concussion protocol
- A update of the new "Return-to-Play" protocol
- What to do when they don't improve (referrals and rehab)

DEFINITION

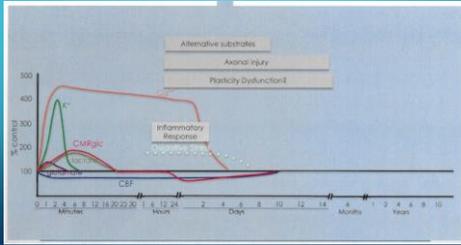
"Traumatic brain injury (TBI) occurs when there is a blow or jolt to the head due to rapid acceleration or deceleration or a direct impact. It can also be caused by direct penetrating injury to the brain. Brain function is temporarily or permanently impaired and structural damage may or may not be detectable. Not all blows, bumps, or injuries cause TBI, and the severity of the injury may vary widely."

Manual of Traumatic Brain Injury: Assessment and Management, 2nd Ed.
Felise S. Zollman

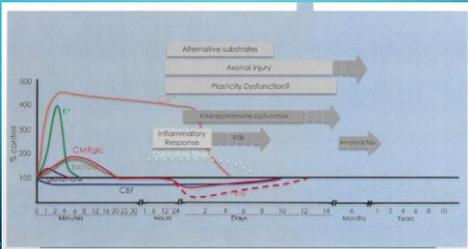
DEMOGRAPHICS

- | Causes | Risk factors |
|----------------------------|------------------------------------|
| - Falls (35.2%) | - Age (extremes of ages) |
| - MVAs (16.5%) | - Gender (young males) |
| - Struck by object (16.5%) | - SES (lower socioeconomic status) |
| - Assaults (10%) | |

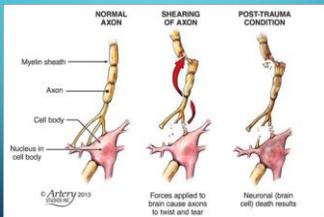
ONGOING CONCUSSION PATHOPHYSIOLOGY



REPEAT CONCUSSION PATHOPHYSIOLOGY



AXONAL INJURY & "MICRO-SHEARING"



SPORTS-RELATED CONCUSSION



- Sport related concussion is a traumatic brain injury induced by biomechanical forces. Several common features that may be utilized in clinically defining the nature of a concussive head injury include:
 - SRC may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an impulsive force transmitted to the head.
 - SRC typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. However, in some cases signs and symptoms evolve over a number of minutes to hours.
 - SRC may result in neurophysiological changes, but the acute clinical signs and symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.
 - SRC results in a range of clinical signs and symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive features typically follows a sequential course. However, in some cases symptoms may be prolonged.
 - The clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction, etc) or other comorbidities (eg, psychological factors or co-existing medical conditions).

Consensus statement on concussion in sport—the 5th International conference on concussion in sport held in Berlin, October 2016

SYMPTOMATOLOGY

Thinking/ Remembering	Physical	Emotional/ Mood	Sleep
Difficulty thinking clearly	Headache Fuzzy or blurry vision	Irritability	Sleeping more than usual
Feeling slowed down	Nausea or vomiting (early on) Dizziness	Sadness	Sleep less than usual
Difficulty concentrating	Sensitivity to noise or light Balance problems	More emotional	Trouble falling asleep
Difficulty remembering new information	Feeling tired, having no energy	Nervousness or anxiety	

PRIMARY CARE ROLE

Mild Traumatic Brain Injuries/Concussions

History

- Acute
 - How injury occurred
 - Type of force
 - Location on the head or body
 - Amnesia—anterograde versus retrograde
 - LOC—how long?
- **RED FLAGS**
 - Observe closely for first 24-48 hours
 - Repeated vomiting
 - Deteriorating cognition



DO'S AND DON'TS

<u>Do</u>	<u>Don't's</u>
<ul style="list-style-type: none"> • Promote sleep • Promote healthy eating and adequate hydration • Avoid external stimuli • Avoid exertional activity • If not seeing progression within 5-7 days refer to specialist • Limit cellphones and earbuds • Screen for Mental Health 	<ul style="list-style-type: none"> • Use zolpidem, antihistamines, or alcohol • Use narcotics for headache • "Lock Them Down"

PRIMARY CARE PHYSICIAN SCREENERS

ACE – (good for ER visit & Urgent Care screening)

SCAT5 – good for first 48+ hours – 5 days

Children's SCAT5 - good for first 48+ hours - 5 days

CONCUSSION MANAGEMENT



- Recovery of concussion
 - *In 80-90% athletes, physical symptoms resolve in 7-10 days*
 - May be longer in children and adolescents 2-3 weeks (new research)
- Cornerstone = *Physical and Cognitive rest until acute symptoms have resolved*
- REST period:
 - *Definite need in acute phase 24-48hrs*
 - *Further research needed to determine optimal rest*
 - *Low-level exercise may be beneficial for prolonged recovery, but timing unknown*

CONCUSSION RECOVERY TIME IN ADOLESCENTS

(COLLINS 2016, NEUROSURGERY)

Recovery is more likely **21-28 days**

- Symptoms improved in ~2 weeks
- Neurocognitive impairment ~ 4 weeks
- Vestibular-oculomotor ~1-3 weeks



Gender differences

- Symptoms seem to be more prominent and last longer in female athletes
- Males less dizziness and less VOMS impairment at 1-2 weeks
- No sex difference in neurocognitive domains

TREATMENT PROTOCOL

Primary Care

- Immediate Diagnosis
- Concussion Protocol
- Neuroimaging†
- Follow-up weekly
- Refer to Specialist
 - Continued symptoms 1-2 weeks
 - Worsening Symptoms
 - Loss of R/L or RTP >4 weeks

REFERRAL

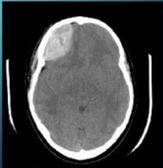


Specialists

- Continued Medical
 - Neuroimaging
 - Labs
 - Specialist referrals
- Neuropsychological Testing
- Treatment
 - Mental Health Therapy
 - Cognitive Rehab

EARLY NEUROIMAGING

- Standard Neuroimaging (CT, MRI)
 - **Contribute little to concussion evaluation**
- Use only when suspicion of structural injury
 - Focal neuro deficit
 - Suspicion of skull fx
 - Prolonged LOC (> 1 min)
 - Worsening symptoms



SPECIALIST SCREENERS

- **ImPact** ~ *Controversy on Baselines*
- **King-Devick** ~ *MAYO Clinic (Higher specificity and sensitivity than common routine screening: pap smear, mammograms)*
- **SWAY** ~ *FDA Approved*
- **Headrest** ~ *(research starting)*
- **CTIP** ~ *(malingering)*

BRAIN INJURY SPECIALIST

- **Diagnosis**
 - Cognitive evaluation
 - VOMS, tandem gait, BESS
 - Laboratory work-up
 - Neuroimaging
 - Neuropsychological evaluation
 - Computerized cognitive assessment
- **Laboratory Work-up**
 - T4 and TSH
 - Estrogen and testosterone
 - CMP
 - GH
 - IGF-1
 - ACTH
 - Vitamin D
 - Vitamin B12
 - CBC

BRAIN INJURY SPECIALIST (CONTINUED)

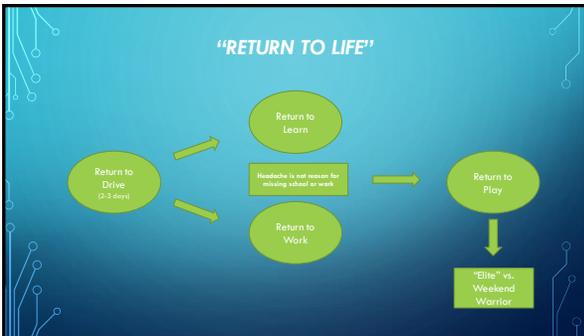
- **Neuroimaging**
 - T-1
 - T2-weighted with FLAIR (white matter changes)
 - DWI (diffusion weighted image)—shows swelling, disruption of white matter, injured neurons and glia
 - SWI (susceptibility weighted image)—pick up on deoxyhemoglobin, ferritin, and hemosiderin
 - DTI (diffusion tensor imaging)—traumatic axonal injury
- **Management**
 - Sleep, headache management, mood regulation
 - Subconcussion treatment
 - Vestibular
 - Oculomotor
 - Cervical spine
 - Cognitive rehab
 - Mental Health Counseling

ROLE OF NEUROPSYCHOLOGY

Neuropsychological assessment (NP) has been previously described by the CISG as a 'cornerstone' of SRC management. Neuropsychologists are uniquely qualified to interpret NP tests and can play an important role within the context of a multifaceted—multimodal and multidisciplinary approach to managing SRC. SRC management programs that use NP assessment to assist in clinical decision-making have been instituted in professional sports, colleges and high schools.

Post-injury NP testing may be used to assist return-to-play decisions and is typically performed when an athlete is clinically asymptomatic. However, NP assessment may add important information in the early stages after injury. There may be particular situations where testing is performed early to assist in determining aspects of management—for example, return to school in a pediatric athlete. This will normally be best determined in consultation with a trained neuropsychologist.

Consensus statement on concussion in sport—the 5th international conference on concussion in sport held in Berlin, October 2016



RETURN TO LEARN

- Testing Accommodations
- Note Taking
- Workload Reduction
- Breaks
- Extra Time
- Attendance
- Follow-ups
