



**[Flawless]**  
Sports Medicine Concepts



Get Your Coffee and Get Comfy. We'll Start in Just A Few!

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**Mike Cendoma, MS, ATC**

*Sports Medicine Concepts, Inc*

**[Flawless]** Suite of Services Since 1995

- **Founder, Program Director**
  - In 2Min or Less® - Sports Emergency Care Training and EAP Development
  - Team EMOsoft® - Sports Emergency Care Application
  - FMtractor® - Emergency Face Mask Removal
  - Concussion Management Specialist
  - Certified Concussion Clinics



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**Athletic Trainer**

- *All of us at Sports Medicine Concepts practice what we preach every day!*
- *Everything we do comes directly from experiences and observations from the field of play!*
- *We want to know that your sideline is as prepared as ours are!*



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# The CMS Program Syllabus

A serious educational undertaking:  
take you beyond entry-level

**15 EBP CEUs are earned!**

- 4 live sessions;
- Recorded sessions;
- 3 quizzes
  - Live sessions;
  - Recorded sessions;
  - Seminar readings;
- Concussion project:
  - Case study;
  - Essay;
- CPR/AED
- Request for Credential



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# Evidence-Based Practice



We are all fully committed to ALL 3 phases of  
evidence-based practice.

- Peer-reviewed literature
- Expert Opinion
  - Situation Scenario Simulation Testing
  - Field Evaluations
- Pragmatic Application



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# Pragmatic Application



How does it actually happen Friday  
night?



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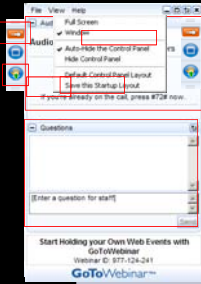
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## How to Participate Today



- Open and close your Panel
- View, Select, and Test your audio
- Submit text questions
- Q&A addressed at the end of today's session

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## Mechanism of and Pathophysiology of Injury

*Injury Mechanisms, Protection, and Injury Cascade as a foundation for assessment, rehab, and return to play*



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## Mechanism of Injury

*"What happened" isn't good enough*

### Coup Injury

Forceful blow to the resting, movable head produces maximal injury beneath the point of impact

- Direct transmission of force to underlying tissue
- No brain lag or disproportionate distribution of CSF

### Contra-Coup

A moving head collides with a stationary object

- Maximal injury on side of brain opposite blow
- Brain lags toward trailing surface
- CSF squeezed away from trailing surface and thickens under point of impact

Genovese T. Mechanisms of brain injury. J Emerg Med. 1993;11(suppl 1):5-11.

Schneider RC. Head and neck injuries in football: Mechanisms, treatment and prevention. Baltimore, MD: Williams & Wilkins; 1973.

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## Coup/Contra-Coup Combined

Many sports-related concussions result from combined mechanism

- Injury on the side of impact and opposite side due to brain lag
- Managed the same



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## Focal Intra-cerebral Trauma

Uncommon in helmeted Sports

- Post-traumatic intra-cranial mass lesions
- Hematoma or cerebral contusions
- Clinical deterioration
- LOC
- CNN deficits
- Lucid interval
- Widened pulse - pressure



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11

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## Diffuse Intra-Cerebral Trauma

Widespread disruption of neurological function

- Involve acceleration-deceleration motion
- Linear plane or rotation or both
- Lesions result from brain being shaken within skull



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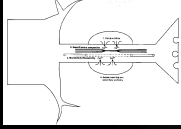
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## Diffuse Axonal Injury



Note to self: Write-up central neuro representation case study report

### Most severe diffuse brain injury

- Caused by rotational accel-deceleration
- Cognitive function
- Concentration
- Memory
- Brain-stem centers
  - Breathing, HR, wakefulness

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## Cerebral Concussions

Most often associated with sports

Mild diffuse injury termed MTBI

- Acc/dec mechanism resulting in 1 or more of the following
  - Headache, nausea, vomiting, dizziness, balance problems, feeling 'slowed down', fatigue, trouble sleeping, drowsiness, sensitivity to light or noise, LOC, blurred vision, difficulty remembering, or difficulty concentrating.

Practice parameter: the management of concussion in sports (summary statement). Report of the Quality Standards Subcommittee of the American Academy of Neurology. Neurology. 1997;48:581-588.

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14

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## Parietal Lobe



- general sensory function
- temperature
- pressure
- pain
- proprioception
- speech

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## Temporal Lobe



Organization of sensory input

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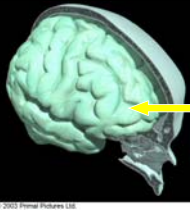
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## Frontal Lobe



motor control of voluntary skeletal muscles  
personality  
concentration  
complex problem solving

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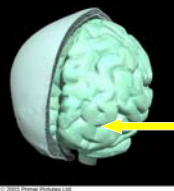
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## Occipital Lobe



vision and integration of vision with other sensory experiences

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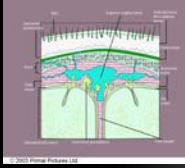
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## Other Cool Clinically Relevant Anatomy



### SCALP

- Skin
- Connective tissues
- Aponeurosis
- Loose areolar tissue
- Periosteum

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## Skull



### Bones of the face

- limited protective role

### Bones of the cranium

- primary role of protection and support

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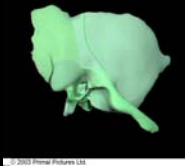
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## Temporal Region



Most often  
associated with  
concussion injury

Middle Meningeal aa.

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## Middle Meningeal Artery



Branch of the first part of the maxillary and is the largest of the meningeal arteries.

Once inside the skull, it follows a groove on the temporal bone

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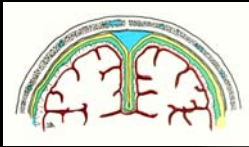
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## The Meninges



Enclose the spinal cord and brain

channel forces away from vital structures

- provide passageway for blood vessels, lymphatic vessels, and nerves

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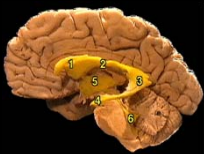
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## Ventricles



Lateral ventricles

first/second

right/left

Third ventricle

Fourth ventricle

- absorb external forces

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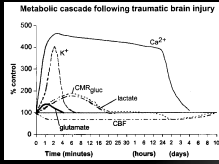
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## Neurometabolic Injury Cascade



- Mild cases
- few seconds of unresponsiveness
  - no histological damage
- Cells may eventually recover or degenerate and die

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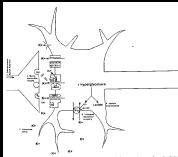
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## Spreading Depression



- Potassium
  - Ionic flux and spreading depression
  - wide area of brain affected simultaneously
  - LOC, amnesia, cognitive impairment
- Hyperglycolysis and HLA production

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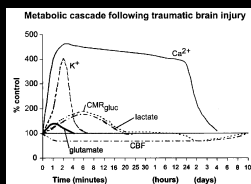
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## Metabolic Cascade



- Potassium Efflux and Hyperglycolysis
- Uncoupling of Cerebral Blood Flow and Glucose Metabolism

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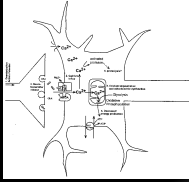
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## Calcium Cascade



Traumatic brain injury and calcium influx  
 Inhibition of oxidative metabolism  
 Delayed cell death and secondary degeneration

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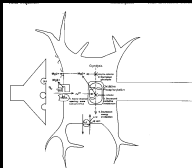
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## Magnesium Cascade



Mg+ influx  
 • dec.mitochondrial function  
 • dec.oxidation

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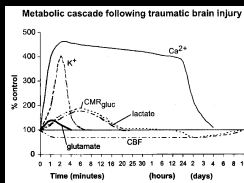
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## Cascade Implications for RTP



On average athletes require 7-10 d to fully recover  
 Same season repeat injuries occur 7-10 days after initial injury  
 Increased vulnerability or blood-flow changes

*RTP should be a progression that starts after the athlete is symptom free for 7-10 days – Really? Hmmm*

Guskiewicz KM, McCrea M, Marshall SW, et al. Cumulative effects of recurrent concussion in collegiate football players: the NCAA Concussion Study. JAMA. 2003;290:2549-2555.

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# Return-to-Play

30% of HS and college FB players returned same day  
70% averaged 4 days  
Most RTP guidelines suggest athletes be symptom free for a minimum of 7-10 days.

7-10 day waiting period can minimize risk of recurrent injury  
Neurocascade review may tell us why

Guskiewicz KM, Bruce SL, Cunniff RC, Ferrara MS, Kelly JP, McCrea M, Penick M, Volorich McLeod TC. National Athletic Trainers' Association position statement: management of sports-related concussion. 2004;29:240-247.

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31

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# Conclusion

*Mechanism of injury*

Focal vs. Diffuse  
Coup vs. Contra-Coup  
Protection of the Brain

*Neurochemical cascade*

Foundation for LOC via Spreading depression  
Uncoupling of CBF  
Foundation for RTP criteria  
Second Impact Syndrome and Post-Concussion Syndrome

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32

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# For Tomorrow

Session Review

- Recording posted shortly
- Power Point link

Readings

- Neurocascade Article
- Hematoma vs. Concussion for tomorrow



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# Cool Stuff

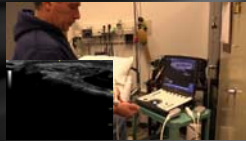
## Informational Fridays at Sports Medicine Concepts

- 10 min video segments that provide product, protocol, and technique reviews using our new RPSH index
- Subscribe on YouTube today!

## Sports Emergency Care White Paper Sessions

- We address issues and burning questions that arose during our most recent In 2Min or Less!® training sessions
- 1 Cat A hr of CE for athletic trainers

Check out links in materials section for details



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