Post-concussion Syndrome
Rehabilitation Strategies in practice
Cheryl Pitre M.D.
• No relevant financial relationships to disclose
OBJECTIVES

Define Post-Concussion Syndrome
Review Office Assessment
Review Rehabilitation options
Review Outcomes
Affinity Sports
Concussion Clinic

Dr. Christopher Birn-pediatrics-Appleton
Dr. Willa Fornetti-primary care sports medicine-Oshkosh
Dr. Alex Garcia-primary care sports medicine-Appleton
Dr. Patricia Howe-pediatrics-Neenah
Dr. Cheryl Pitre-primary care family practice-Menasha
Dr. Wendy Schroeder-primary care family practice-Greenville

Kerrie Linsmeyer-Lead Athletic Trainer
-LATs
-physical therapists
-speech therapists

Consultant Resources:
  Dr. T. Edgar-pediatric neurology
  Dr. M. Jaffri, R. Jones-teen-adult neurology
  Dr. S. Price-adult neurology
Catalpa Health-pediatric neuropsychology,behavioural health
Post concussion syndrome

Symptoms longer than 3-4 weeks-10-20% of adolescent concussions

Headache
Insomnia
Dizziness-vestibular system deficits
Exercise intolerance-dysautonomia
Cognitive Impairment-memory problems
-adjustment disorders*

SECONDARY EFFECTS

-academic
double work load-catch up, anxiety with test requirements, maintaining GPA, ACT’s, college applications

-inactivity-deconditioning-loss of position on team

-loss of employment, household chores

THIS ALL CONTRIBUTES TO -social isolation
school teams, clubs, music participation in class, band and home, family events, vacations, activities with friends
ASSESSMENT

**History**- confirm concussion, side-line testing, trainer reports, office visit documentation, symptom log, neurocognitive reports

**PMH**- Migraine, depression, anxiety, chronic insomnia, ADHD or learning disability, amblyopia/strabismus, visual tracking disorders**

-TBI can exacerbate these conditions and they in turn can be responsible, if only partially, for ongoing symptoms.

**Medications-rule out drug side effects**

**Prior Concussions-especially those not reported-detailed questioning with patient**

**Hallowell, EM. Delivered from Distraction:Getting the Most out of Life**
RED FLAGS-risk for PCS

• **PRACTICE OBSERVATIONS**
  - type A personality, anxiety
  - female
  - chronic headache
  - hx of insomnia
  - concussions within close time frame
  - return to play while symptomatic
  - not recovered from prior injury
  - return to school with severe symptoms

• **REPORTED IN LITERATURE**
  - ?LOSS OF CONCIOUSNESS*-yes-pediatric population not adults*
  - ?AMNESIA-no
  - ?VESTIBULAR DYSFUNCTION-YES
  - ?PRIOR CONCUSSION-Yes
  - ?RETURN TO SCHOOL TOO EARLY**-Yes
  - ?Examination findings-will review later

EXAM

• Level of Alertness

• Focus/Concentration

• Symptom Report

Observation

• Response time to questioning, relying on others to answer

• Fidgeting, poor eye contact, lack of spontaneous or descriptive responses

SCAT 3 symptom report or equivalent-pediatric includes parent report
EXAM-continued

• Autonomic Dysfunction

• Orthostatic vitals - signs of dysautonomia most evident during exercise but often manifest with this test

Patient supine 2 min-BP & HR; stand 1 min, wait another 2 mins then repeat BP & HR

Positive Test - reduced BP by 20 mmHG systolic or 10 mmHg diastolic or if either @ symptoms
- if change in HR of 20 BPM-hypovolemic, no change neurogenic

**Master CL, Grady MF. Office Based Management of Pediatric and Adolescent Concussion. Pediatric Annals. 2012;41(9):1-6**
EXAM-continued

- Cognitive

- SCAT 3-adult and pediatric available*
- ImPact test-?baseline available
- -not valid if hx of ADHD, learning disability and age less than 11

- Don’t forget the parents-they know their child/athlete, friends and teachers may offer information

*http://bjsm.bmj.com/content/47/5/259.full.pdf
EXAM -continued

• Neurological

  • Cranial nerves, fundi-anosmia CN1
  • Reflexes, Sensation, Power, DTR’s
  • Cerebellar exam
  • Vestibular-ocular-gaze stabilization
  • Vestibular spinal reflex-Balance
VESTIBULAR OCULAR

**Impact**- Impairment with using smart boards, computer screens, notebooks, difficulty with reading, difficulty focusing on a target
Vestibular-Ocular

- Symptoms suggesting abnormality include dizziness, visual blurring, double vision, balance problems
- Up to 40% of TBI patients have vision difficulties interfering with school*

Clinical Exam**

- Dymetria
- Nystagmus-not uncommon if go past 30 degrees in adolescents
- Smooth Pursuits-helps rule out malingering**
- Saccades-predictor of slower recovery*
- Gaze Stability
- Convergence insuffiency- double vision greater than 6 cm-10cm
- Balance-Postural Control -tandem Gait, MBESS
- Consider Ostoscopic exam, Dix Halpike maneuver and visual acuity screen

*Heitger MH et al. Brain 2009
**Master CL, Grady MF. Office Based Mangement of Pediatric and Adolescent Concussion. Pediatric Annals. 2012;41(9):1-6
***Leddy et al JHTR 2013
Assessment

Musculoskeletal

- Neck spasm, Spurling's sign, poor posture-ask study habits/location/ergonomics

- Wikipedia-Provider turns the patient's head to the affected side while applying downward pressure to the top of the patient's head.

the Spurling's test was 95% sensitive and 94% specific for diagnosing nerve root pathology.*

Psychosocial

• Depression
• Anxiety-GAD, test anxiety
• Social Phobia
• Hx of drug use, etoh
• Attention to FH and medications prescribed
  • Insomnia
  • Anxiety

Resources:

• Patient Health Questionnaire (PHQ-9)
• Beck Depression Inventory
• Beck Anxiety Inventory
• Social Phobia Inventory
-How do we help?

Treatment

• Cornerstone of management and RTP is rest until symptoms resolve followed by a graded program of exertion till the athlete can exercise to the full capacity of his/her sport without recurrence of symptoms*

- most patients with concussions will tolerate initially light activities that don’t increase heart rate and symptoms

BUT – increase risk of PCS if not recognizing cognitive recovery comes first then physical recovery**

**Clin J Sport Med 2009,19 185-200
RETURN TO LEARN

-Student returns to school when they can tolerate cognitive activity or stimulation for approximately 30-45 minutes without worsening of symptoms or 1-2 accumulative hrs of homework*

Why?
- A good amount of learning takes place in 30-45 min increments
- Stay below symptom threshold to avoid aggravating symptoms
- Rest breaks before reaching student symptom threshold

Avoid double work load

-new work and make-up work
MEDICAL ACCOMMODATION

Written and documented communication for medical records, parent information, school staff, trainers, coaches, clubs
MEDICAL ACCOMMODATION

Must remember paperwork!

Adapt the school environment and academic demands to facilitate a gradual increase in school activity while staying below the symptom threshold -not all teachers on board, not all communication that is sent to the school reaches all teachers Advocates -parents, counsellors, school nurses and use on-line teacher access- e.g Edline

Caution-PCS-student transitioning from one athletic season to another-ensure restrictions still in effect if indicated with ongoing communication with trainer noting many coaches volunteers vs school staff
But also consider......

- Reassess restrictions for other activities- keep them connected
- Eg: sporting/social events - ear plugs, sunglasses, quiet areas or shortened duration of participation, transportation if symptoms (escape route)
- Group learning (math, clubs, robotics, forensics)
Other Support

Counselling-school counsellors, EAP, religious affiliations, private insurance, Brain Injury Association of America*

*www.biausa.org
If no prior IEP and significant delays anticipated consider 504 plan - check with school-individualized student learning plan may suffice

504 Accommodations: This term refers to Section 504 of the Rehabilitation Act of 1973, which makes the granting of accommodations for a child’s disability by schools a matter of the child’s civil rights. IDEA differs in that its focus is on educational activities, while Section 504’s focus in on requiring due process and prohibition of discrimination based on disability.*

http://www.biausa.org/LiteratureRetrieve.aspx?ID=122155&A=SearchResult&SearchID=7967254&ObjectID=122155&ObjectType=6
• **504 Plan Basics**
  • Students can qualify for 504 plans if they have physical or mental impairments that affect or limit any of their abilities to:
    • walk, breathe, eat, or sleep
    • communicate, see, hear, or speak
    • read, concentrate, think, or learn
    • stand, bend, lift, or work

http://kidshealth.org/parent/positive/learning/504-plans.htm
• **Examples of accommodations in 504 plans include:**
  - preferential seating
  - extended time on tests and assignments
  - reduced homework or classwork
  - verbal, visual, or technology aids
  - modified textbooks or audio-video materials
  - behavior management support
  - adjusted class schedules or grading
  - verbal testing
  - excused lateness, absence, or missed classwork
  - pre-approved nurse's office visits and accompaniment to visits
  - occupational or physical therapy
504 Plans vs. IEPs

• The main difference is that a 504 plan modifies a student's regular education program in a regular classroom setting.

• If students with these plans can't achieve satisfactory academic success, as is determined by the school, then alternative settings in the school or private or residential programs can be considered.

• A 504 plan is monitored by classroom teachers. A student with an IEP, as part of the Individuals with Disabilities Education Act (IDEA 2004), usually receives different educational services in a special educational setting. IEP programs are delivered and monitored by additional school support staff.

• Also, parental approval and involvement is required for an IEP, but not for a 504 plan. Full parental participation in the 504 plan process, however, is important for the student's academic success.

• It's important to note that students with IEPs are also entitled to the additional protections and services offered by 504 plans. Students with IEPs might benefit from a 504 plan, for example, if they're moving from a special education setting to a regular classroom.

*http://kidshealth.org/parent/positive/learning/504-plans.htm
• **Evaluation and Referral**
  - A 504 plan should be considered when a **student isn't benefiting from instruction due to a physical or mental impairment**. The issue can be raised by a parent or legal guardian, teacher, physician, or therapist.
  - A 504 plan can help when a student returns to school after a **serious injury or illness**, or when a student isn't eligible for special education services or an IEP, but still needs extra services to succeed academically. Once an educational concern is raised, the school principal or other academic advisor sets up a meeting of a 504 planning team. The team usually consists of parents, the principal, classroom teachers, and other school personnel (such as the school nurse, guidance counselor, psychologist, or social worker).
  - After reviewing academic and medical records and interviewing the student and parents, the 504 team determines if the child is eligible to have a 504 plan put in place.

• **Reviewing the 504 Plan**
  - The 504 plan should be reviewed at least **annually** to determine if the accommodations are up to date and appropriate, based on the student's needs. Any 504 plan team member, including the parent, may call for a 504 plan review at any time if there is an educational concern or change in the student's needs.
  - The **plan can be terminated** if the 504 team determines that the student:
    - is no longer disabled
    - no longer requires any special accommodations or services to meet the identified needs
    - can be appropriately instructed in general education

Once the plan is developed by the team, **all the student's teachers are responsible** for implementing the accommodations in the plan, as well as participating in plan reviews.
EVIDENCE BASED LITERATURE SUPPORTS REHABILITATION*

*Schneider K et al. CJSM 2009 and 2012
Target Rehabilitation

- **Vestibular therapy** with balance and oculomotor exercises
- High prevalence vestibular dysfunction post TBI
- Higher risk of PCS
- Causes significant disability with daily activities


GOALS OF THERAPY

• Dedicated physical therapists
• Restore deficits in vestibular-ocular reflex and vestibular-spinal reflex
• Improve gaze stability, postural stability-lessening of blurred vision.
• Reduce or eliminate dizziness
• Improve peripheral vestibular disorders, migraine headache, and cervicogenic dizziness*

**Master CL, Grady MF. Office Based Management of Pediatric and Adolescent Concussion. Pediatric Annals. 2012;41(9):1-6**
Rehabilitation—continued

• Aerobic rehabilitation for subsymptom threshold exercise

• **Dysautonomia**—early fatigue with physical/mental activity, postural orthostatic symptoms

• -36% of patients age 11-15 years of age still have reduced cerebral blood flow up to 4 weeks post injury*

• **Treadmill stress test-modified Balke protocol**—GOAL 30 MINUTES SUSTAINED AEROBIC ACTIVITY—modified home program for younger children


Gagnon I, Galli C, Friedman D, Grilli L, Iverson GL. Active rehabilitation for children who are slow to recover following sport-related concussion. Brain Inj. 2000;23(12):956-964
UPDATE

• BCTT-Buffalo Concussion Treadmill Test*

• - continues use of HR and BP at threshold of symptom exacerbation as basis for individualized exercise prescription for patients with PCS

Note....

- Exercise has beneficial effects on cerebral blood flow, improved fMRI cortical connectivity and activation*

- Helps differentiate depression vs concussion-exercise improves symptoms of depression, concussion exacerbated by exercise**

- Cervicogenic headaches-able to exercise to exhaustion unlike concussion-exercise prevents them from continuing

- Exercise symptoms mimicking concussion typically occur at peak exertion vs earlier with concussion


Endpoint

Physiological resolution of PCD is defined as the ability to exercise to voluntary exhaustion at 85%-90% of age predicted maximum HR for 20 minutes without exacerbation of symptoms*

-consensus opinion that the ability of concussed athletes to perform provocative exercise without symptom exacerbation established readiness to return to play **


Rehabilitation-continued

- **Speech therapy** for working memory and executive functioning, eye tracking
- Understand and use language
- Assist with cognitive skills
- Assist with communication-verbal and non-verbal; listening, speaking, gesturing, reading, writing
- Assist with cognition-attention, perception, memory, organization, executive function
- Collaborate with school for support and accommodation
- Neuropsychologist-8-12 weeks persisting symptoms*

Students should be performing at their academic baseline before returning to sports, full physical activity, or other extracurricular activities following a concussion*

**Master CL, Grady MF. Office Based Management of Pediatric and Adolescent Concussion. Pediatric Annals. 2012;41(9):1-6**
2009-2014
TOTAL Concussion Visits-201
Post Concussion syndrome-16

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<tr>
<th>PROFILES</th>
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<td>Average Age</td>
<td>14.5 yrs.</td>
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<td>Female</td>
<td>PCS-13 <strong>(81.25%)</strong> Concussion -113 (%56)</td>
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<td>Average time to 1st visit</td>
<td>21.5 days</td>
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<tr>
<td>History of Prior Concussion</td>
<td>7 (43%)</td>
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<tr>
<td>Amnesia</td>
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<td>Cervical Injury</td>
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<td>Depression or Anxiety</td>
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<td>Average # Speech Therapy Visits</td>
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<td>Returned to Sport Baseline</td>
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SUMMARY

- CORRECTION OF BASE-LINE CEREBRAL PERFUSION CAN TAKE UP TO 3-4 WEEKS IN CHILDREN

- COGNITIVE RECOVERY BEFORE RETURN TO SPORT

- EARLY MEDICAL COGNITIVE AND PHYSICAL ACCOMMODATION OPTIMIZES OUTCOME

- SYMPTOMS ARE MULTIFACTORIAL-ASSESS FOR OTHER CAUSES

- SIGNIFICANT COMPONENT OF VESTIBULAR DYSFUNCTION IN PCS

- EVIDENCE SUPPORTS REHABILITATION-ADULTS AS EARLY AS 3 DAYS; 14-21 DAYS YOUNGER POPULATION*

*LEDDY JJ, WILLER B. USE OF GRADED EXERCISE TESTING IN CONCUSSION AND RETURN TO ACTIVITY MANAGEMENT. CURR SPORTS MED REP 2013 NOV-DEC;12(6):370-6
THANK YOU....

cpitre@affinityhealth.org
Physical Therapy in Post-Concussion Syndrome
Jenna Lemberger PT, DPT
• 3 focuses:
  – Cervical/ Musculoskeletal Pain
  – Vestibular
  – Exercise tolerance
Treatment of Cervical Spine Pain

- Manual Techniques - Trigger Point Release, soft tissue mobilization, Myofascial Release
- Kinesiotaping
- Stretching - Suboccipitals, paraspinals, upper trapezius, levator scapulae, SCM, scalenes
- Postural correction - including head tilt/rotation
- Encouragement to move neck normally
- Use of cervical collar is highly discouraged
3 Categories of Dizziness

– Posttraumatic Positional vertigo
  • Hallpike Dix is Positive

– Posttraumatic migraine associated dizziness
  • Headaches, Normal posture, abnormal gait testing, abnormal occulomotor function

– Posttraumatic spatial disorientation
  • Abnormalities on posture, gait tests, abnormal occulomotor function, would also have abnormal VNG testing

Vestibular

• Treatment of deficits in:
  – Balance deficits
  – Dynamic visual acuity
  – Cervicogenic Dizziness
  – BPPV
  – Difficulty with Visual Stimuli (visual vertigo)
  – Postural abnormalities
Testing for Vestibular deficits

- Activities Specific Balance Confidence (ABC) Scale
- Dizziness Handicap Inventory (DHI)
- Dynamic Gait Index (DGI) or Functional Gait Assessment (FGA)
- Saccades
- Smooth Pursuit
- Convergence/ Divergence
- VOR x 1 (gaze stabilization)
Treatment Strategies

- VOR x1
- Dynamic Visual Acuity- Snellen eye chart on a variety of surfaces
- Desensitization to visual stimuli (visual Vertigo)
- Reintegration of visual stimuli
- Navigating environment through looking at signs, reading signs when walking
- Balance training- sitting, standing
- Visual Tracking (volleyball, basketball as needed for gym, sport)
- Integration of patient specific functional limitations

• **Exercise Tolerance**
  – Using Buffalo Concussion Treadmill Test (BCTT)
  – Modifications to protocol
    • Blood Pressure not required to be taken during exercise test
    • Full 90 minute recovery not required as long as the patient is returning to baseline HR
    • Deferred when symptoms >7/10 per new Leddy article
    • Prescribe exercise at 80% of threshold HR on test once per day 5-6 days per week
    • Must continue to have someone present
    • Progress HR 5-10 bpm every 2 weeks
    • May retest BCTT after 2-4 weeks as needed to establish new baseline

• Any questions?

Thank You!
Speech Therapy
In Post-Concussion Syndrome
Rebecca Meck, MS, CCC-SLP
Cognitive-Communication Therapy

- Language
- Attention
- Memory
- Executive Function
Language

• Expressive and Receptive
• Visual (Graphic)
• Verbal
• **Digital media**

• Goal: Ability to toggle/process through all of these modes within a learning activity
Attention

• Sustained
• Divided/Alternating

• Goal: Effective and efficient completion of school work; ability to participate fully in learning activities
Memory

- Immediate
- Short term
- Internal/External strategies

- Goal: Retention of new information
Executive Function

- Planning
- Organizing
- Managing time/space
- Modifying behavior based on experience

- Goal: Ability to create/follow a schedule, self-correction/use of strategies, ability to recognize potential symptom triggers
Testing Protocols

- SLUMS, MOCA, MMSE
- Woodcock-Johnson
- RIPA
- SCATBI
Treatment Protocols

• Structured tasks within areas of deficit
• Add complexity with task, mode, time constraint
• Encourage students to bring own stimuli from current studies to allow for carryover skills, once applicable
When to refer to others…

• Complex somatosensory deficits (OT)
• Symptoms of mental health changes (Psych)

OR…

• Carryover established and demonstrated with assistance (504 or IEP)
• Questions?

Thank you!