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Head Injuries in Children and Prevention

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thinkfirst



pensezd'abord
CANADA

Objectives



- Review common head injuries in children including concussions and their management
- Discuss head injury prevention
- Advise on return to learn and return-to-play

Disclosures

- None



Introduction

- Unintentional injury among children
 - Very serious public health issue
 - Imposes a heavy burden on the healthcare system
 - Leading cause of death among children 1-14 years of age.
 - Second-ranked cause of hospitalizations



Unintentional Injuries

- Falls, motor vehicle collisions, fires, poisonings
- Falls
 - Largest cause of traumatic head injuries among children and youth
 - Primarily through sports and recreational activities

Cycling without a helmet

- One of the leading causes of sports and recreation-related head injury
 - Can be prevented/reduced with intervention programs:
 - Effective and inexpensive means of reducing injury among children

Wear it *right*

Know your helmet salute



2

Two fingers above your eyebrow to the bottom of your helmet.



4

Four fingers to make a V-shape around the bottom of your ears.



1

One finger under the strap beneath your chin.

Traumatic Brain Injury (TBI)

- Major cause of death and severe disability
- Two causes
 - Impact damage (primary injury)
 - Secondary injury
 - Develops after the impact
 - Progression of hemorrhage, cerebral swelling, decreased brain perfusion because of shock

TBI- Classification

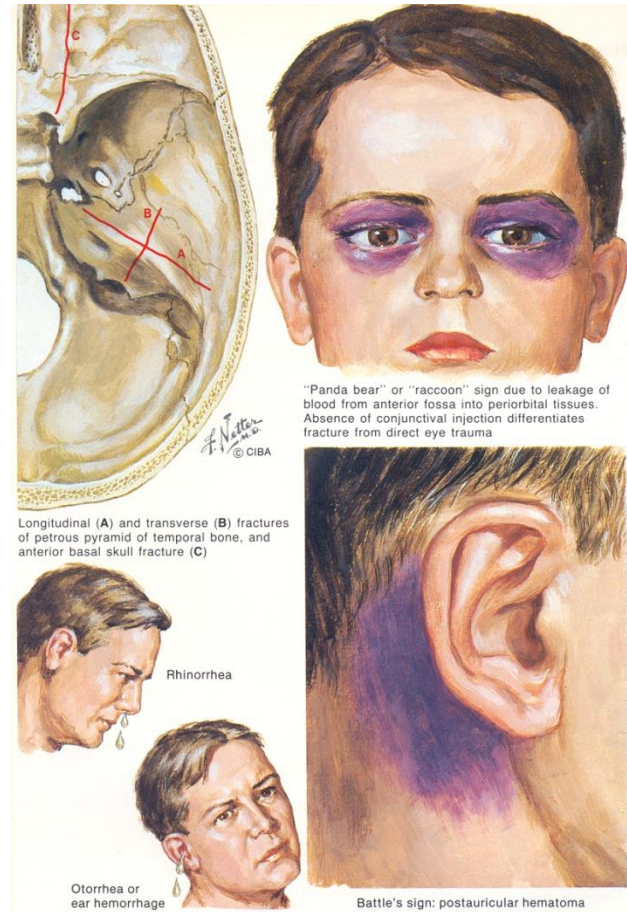
- Closed head injury
 - Focal brain injury
 - Contusion
 - Epidural hematoma
 - Subdural hematoma
 - Diffuse brain injury
 - Concussion
 - Diffuse axonal injury
- Penetrating head injury

Skull Fractures

- Linear
- Diastatic
- Basal
- Comminuted
- Depressed
- Compound
- Growing

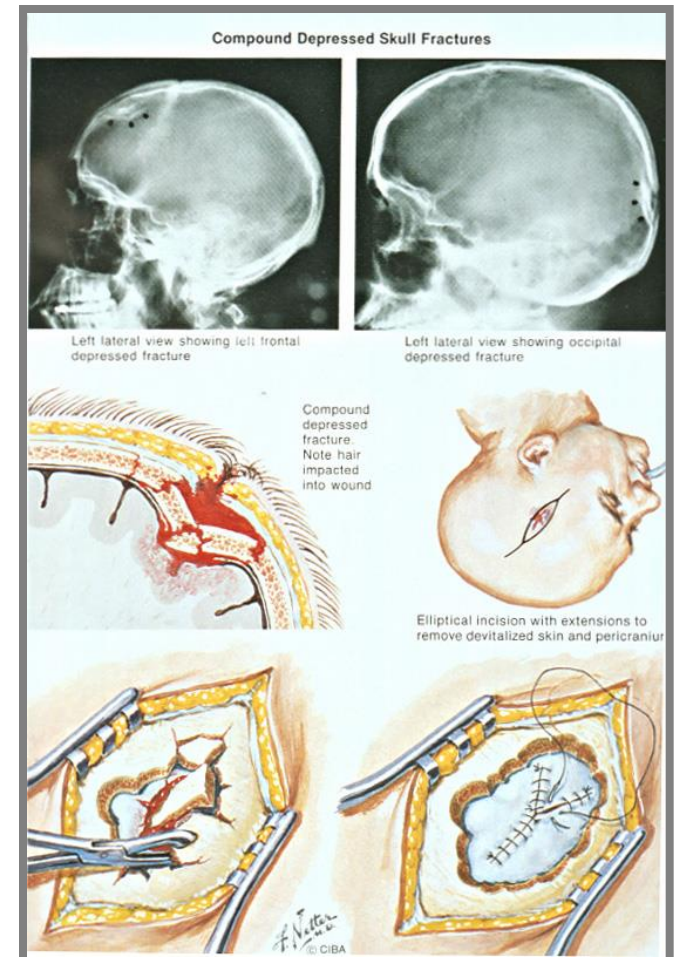


Basal Skull Fracture

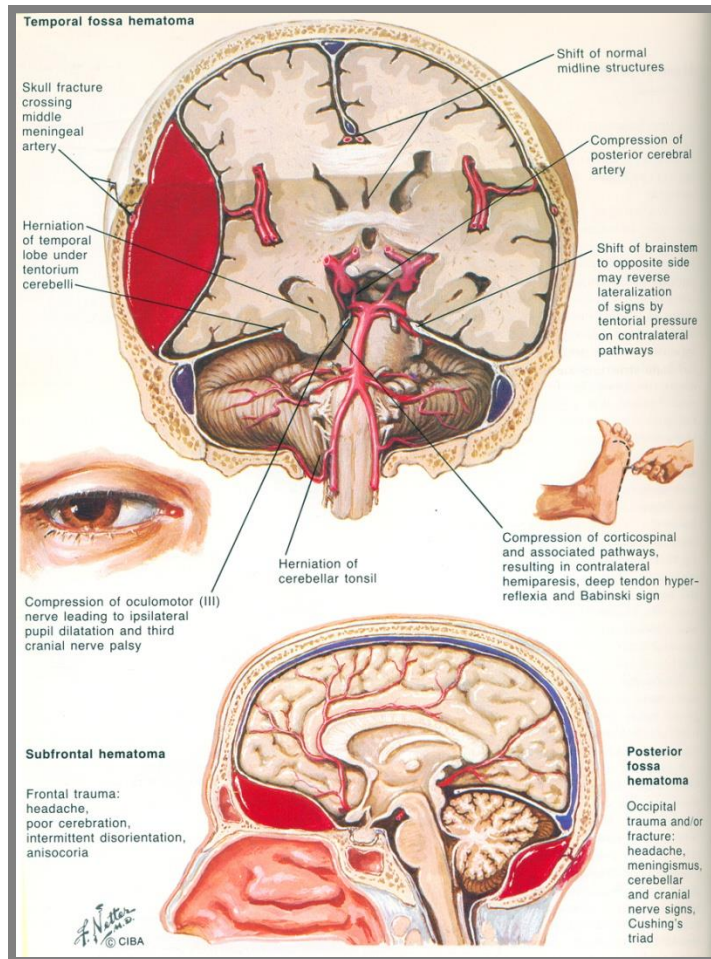


Depressed Skull Fracture

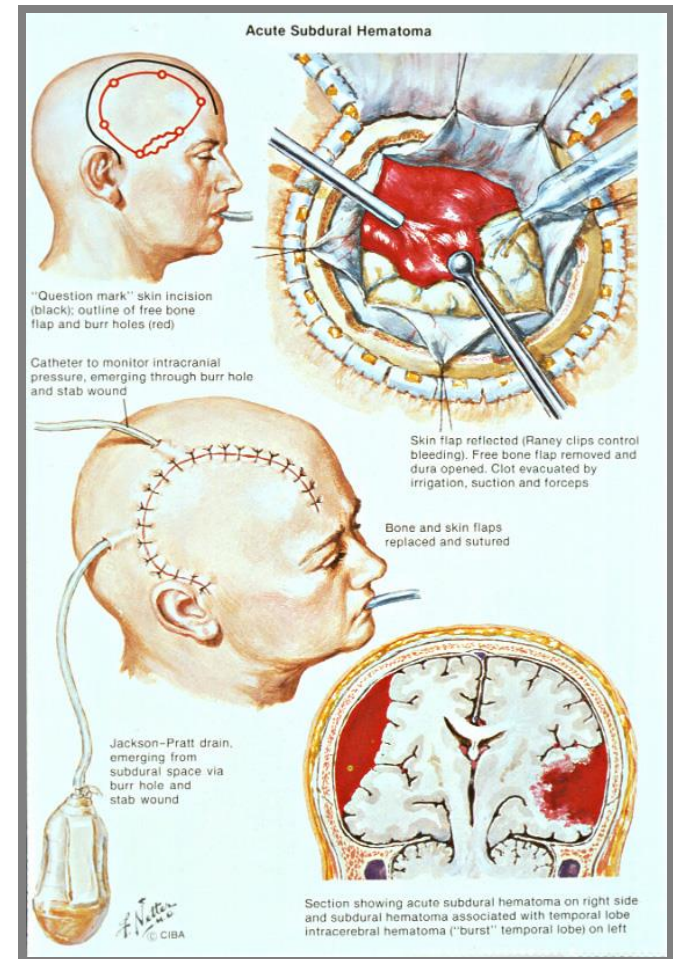
- 6% of head injuries
- May be compound
 - Infection rate 2-11%
 - Late epilepsy
 - Up to 15%
 - Morbidity
 - 11%
 - Mortality
 - Up to 19%



Epidural Hematoma



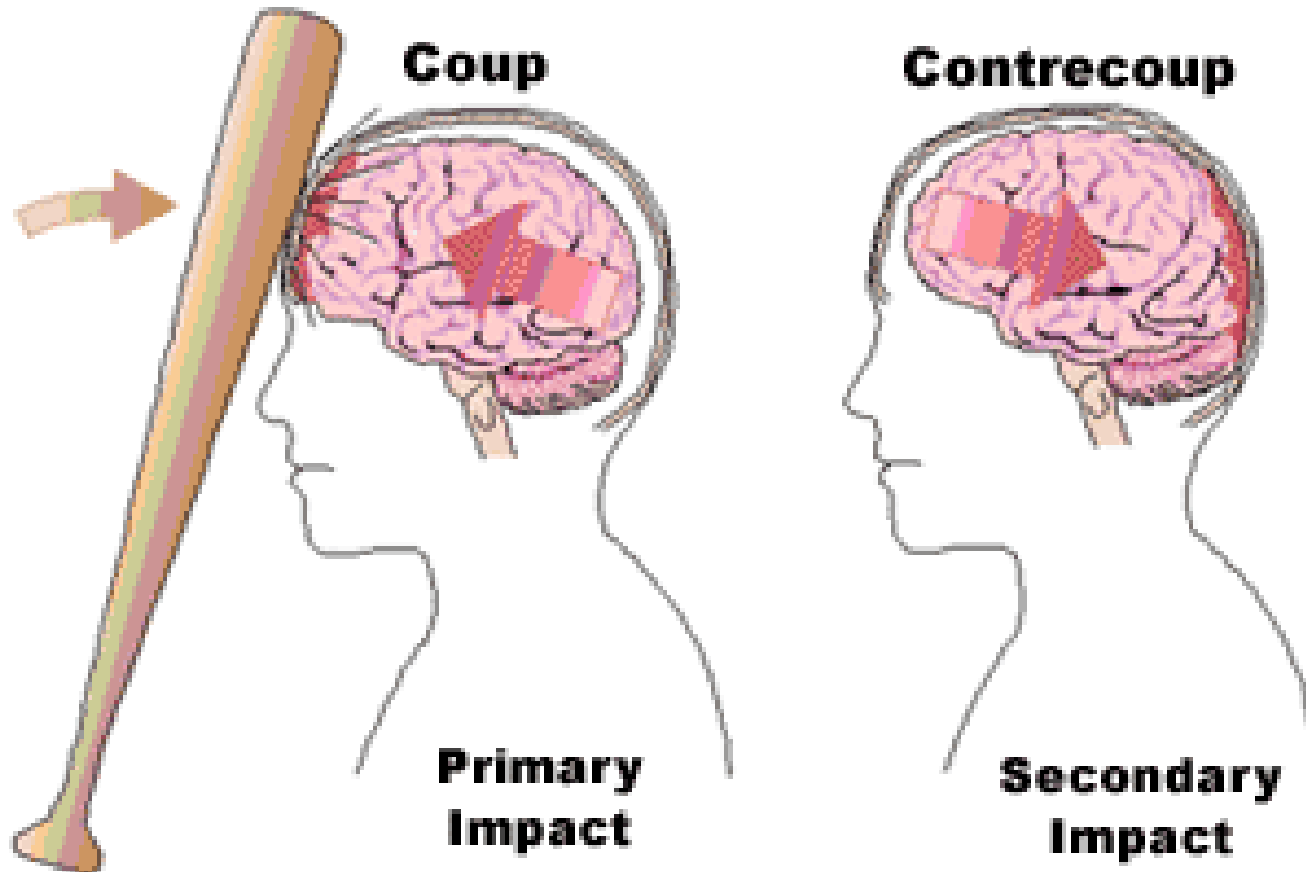
Subdural Hematoma



Cerebral Contusion

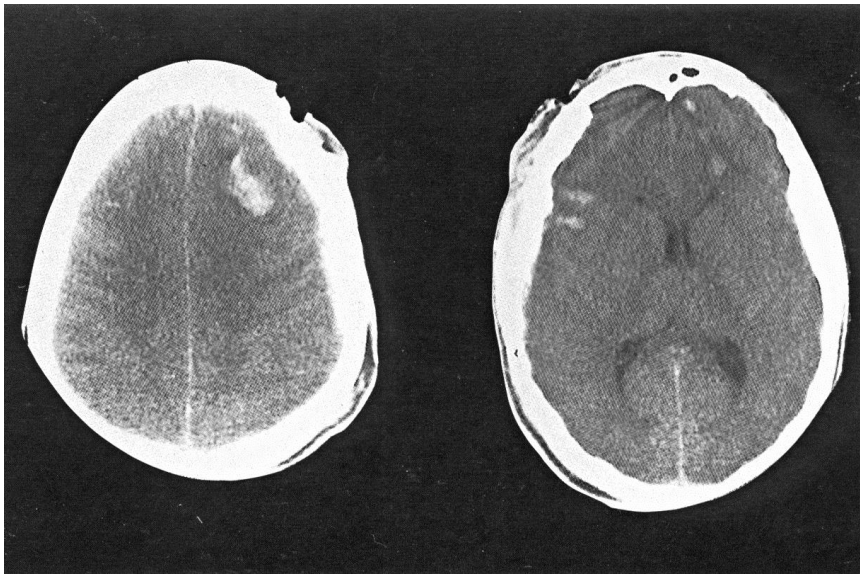
- “Brain bruise”
- Often enlarge and coalesce
- Apparent on Brain CT/ MRI
- Sudden deceleration causes brain to impact on inner skull prominences
 - Coup/ Contre coup injury

Cerebral Contusion

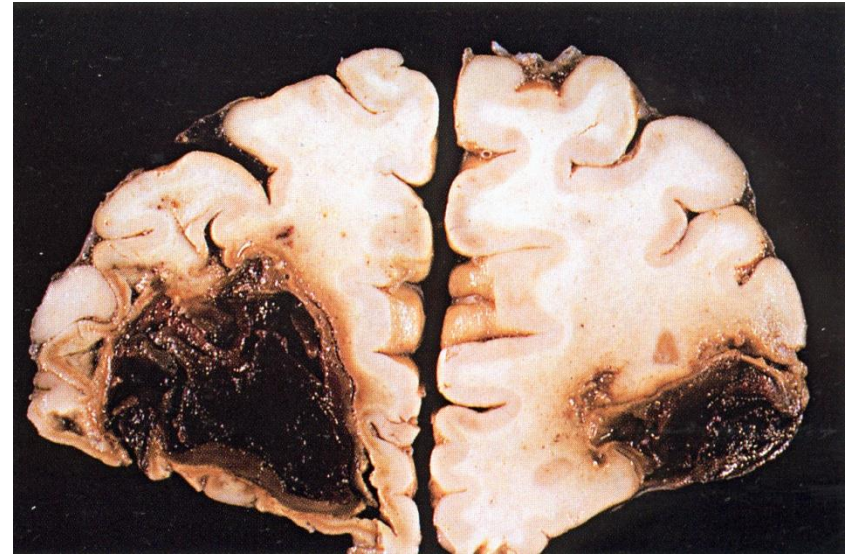
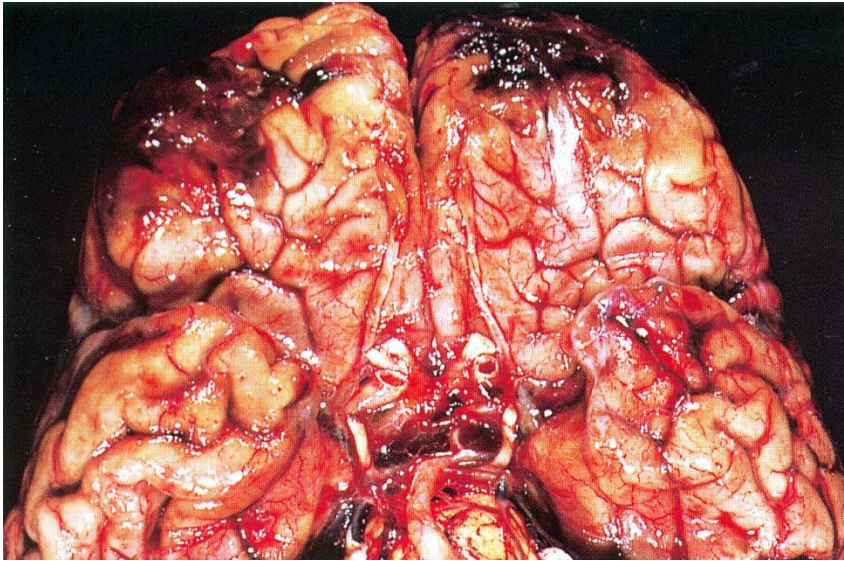




Cerebral Contusion



Intraparenchymal Hematoma



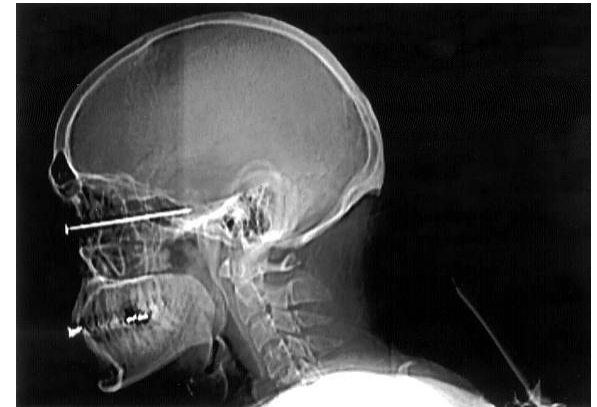
Diffuse Axonal Injury

- Shearing of axons
- Rotational acceleration/ deceleration
- Multiple hemorrhagic foci in the brain that may be too small to see on CT/ MRI



Penetrating Head Injuries

- Etiology
 - Missile wounds
 - Stab wounds
 - Intentional
 - Non intentional
 - Occupational injuries
 - Nails, screwdrivers,...
 - MVA



“Lucky” 14-month-old boy survives after chopsticks pierces his brain through his nostril



© Quirky China/Barcroft Media



Sports Related Concussions



Chronicle / Lacy Atkins

If you're concussed:

- *Reaction time increased*
- *Processing time is increased*
- *Memory impaired*
- *More prone for mistakes*
- *More prone for another concussion*



Concussion Symptoms

Common symptoms of concussion cluster in 4 general categories:

1. Physical
2. Emotional
3. Cognitive
4. Maintenance





Physical Symptoms

- Headache
- Blurred vision
- Nausea
- Dizziness
- Poor balance
- Ringing in ears
- Seeing “stars”
- Vacant stare
- Vomiting
- Numbness/tingling
- Sensitivity to light
- Sensitivity to noise
- Disorientation
- Neck pain



Emotional Symptoms

- Inappropriate emotions
- Change in personality
- Nervousness / anxiety
- Feeling more “emotional”
- Irritability
- Sadness
- Lack of motivation



Cognitive Symptoms

- Feel “in a fog”
- Feel “slowed down”
- Difficulty remembering
- Difficulty concentrating / distracted
- Slowed speech
- Easily confused



Maintenance Symptoms

- Fatigue
- Excess sleep
- Trouble falling asleep
- Drowsiness
- Sleeping less than usual

Medical Attention Required When:

- Loss of consciousness
- Seizure activity
- Severe headaches
- Confusion
- Nausea/ vomiting
- Diplopia
- Neurological deficit



Maddocks Questions

- ✓ *Scientifically validated (any incorrect response indicates concussion)*
- ✓ *Quick, simple and practical*

1. Which field are we at?
2. Which team are we playing today?
3. Who is your opponent at present?
4. Which half/ period is it?
5. How far into the half is it?
6. Which side scored the last touchdown/ goal/ point?
7. Which team did we play last week?
8. Did we win last week?



Physician Advise with Head Injuries

- Do not return to play:
 - If there are any persisting symptoms
 - If there are any neurological deficits
 - If there are any diagnostic imaging abnormalities
- Once symptoms have resolved then may proceed with “step-wise return to play” protocol



Concerns with Concussion

- Post Concussion Syndrome
- Second Impact Syndrome



Post Concussion Syndrome

- Collection of symptoms as a sequel to a head injury
- ? Contribution of psychological factors
 - *Conversion reaction*
 - *Secondary gain*
 - Attention, financial reward, drug seeking,...



Symptoms of Post Concussion Syndrome

- Decreased processing speed
- Short-term memory impairment
- Concentration deficit
- Irritability/ depression
- Fatigue/ sleep disturbance
- General feeling of “fogginess”
- Academic difficulties



If symptoms persist and are left untreated:



- Teachers and family may notice increased irritability
- School work may begin to suffer
- Behaviour may be attributed to factors other than the head injury
- If the child continues to experience problems it could lead to depression or “acting out”
- At risk for academic and social difficulties
- At risk for further brain injury

Second Impact Syndrome



- Rare, in athletes < 21 years of age.
- May result from a subsequent concussion(s) when the individual is still symptomatic from the first.
 - *There is a period of time that brain is more susceptible to a second injury*
 - The young brain loses its ability to autoregulate its blood supply which leads to vascular engorgement, marked increase in intracranial pressure, brain herniation and ultimately coma and death

Chronic Traumatic Encephalopathy

- Progressive degenerative disease of the brain found in people with a history of repetitive brain trauma
- First described in boxers
- Causes intellectual decline, balance impairment, slurred speech, tremor



Potential Long Term Effects

1. Alzheimer's
2. Learning disability
3. Decreased attention
4. ALS
5. Parkinson's
6. Personality change
7. Depression
8. Suicide ideation
9. Substance abuse
10. Chronic pain issues





Prevention

- Regardless of the steps taken to prevent injury, some athletes will continue to be injured
- The severity of the injury can be mitigated by the following:
 1. **Education** for officials, referees, coaches, parents and athletes to:
 - a. **Recognize** the symptoms of concussion
 - b. **Remove** the athlete from play
 - c. **Refer** the athlete to a physician



Prevention

2. Wearing the protective equipment appropriate for the sport engaged in:
 - a) Equipment should **fit properly**
 - b) Equipment should be **well maintained**
 - c) Equipment should be **worn consistently and correctly**
3. Athletes should follow their coaches' rules for safety and the rules of the sport

Prevention

4. Teach your child/ teen that it is not smart to play if they had an injury
 - It is not a badge of honour to play injured
 - Discourage others from pressuring injured athletes to play
 - Don't let your child/ teen convince you that he/ she is “just fine”
5. Tell all of your child/ teen's coaches about any concussions suffered in the past

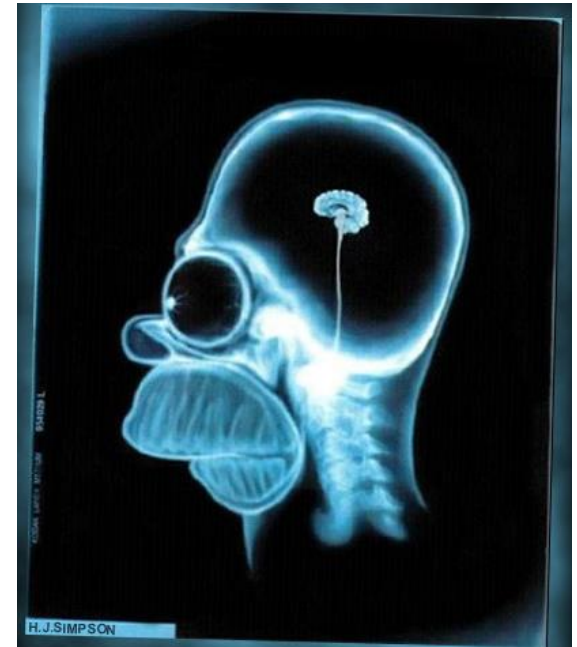
Under reporting of symptoms

- Barriers include:
 - *Excess competitiveness*
 - *Fear of viewing injuries as a weakness*
 - *Fear of being removed from the competition*
 - *Fear of letting down/disappointing the team*
- Student/ athlete may not report the symptoms as they may not have recognized it as a concussion



Imaging of the brain cannot diagnose a concussion, but may be considered when:

- Prolonged LOC (>1 min)
- Focal neurologic deficit
- Worsening of symptoms
- Deterioration in conscious state





When in doubt, sit them out!





CONCUSSION RECOGNITION TOOL 5®

To help identify concussion in children, adolescents and adults



FIFA®

Supported by



FEI

RECOGNISE & REMOVE

Head impacts can be associated with serious and potentially fatal brain injuries. The Concussion Recognition Tool 5 (CRT5) is to be used for the identification of suspected concussion. It is not designed to diagnose concussion.

STEP 1: RED FLAGS – CALL AN AMBULANCE

If there is concern after an injury including whether ANY of the following signs are observed or complaints are reported then the player should be safely and immediately removed from play/game/activity. If no licensed healthcare professional is available, call an ambulance for urgent medical assessment:

- Neck pain or tenderness
- Severe or increasing headache
- Deteriorating conscious state
- Double vision
- Seizure or convulsion
- Vomiting
- Weakness or tingling/numbing in arms or legs
- Loss of consciousness
- Increasingly restless, agitated or combative

Remember:

- In all cases, the basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Assessment for a spinal cord injury is critical.
- Do not attempt to move the player (other than required for safety support) unless trained to do so.
- Do not remove a helmet or any other equipment unless trained to do so safely.

If there are no red flags, identification of possible concussions should proceed to the following steps:

STEP 2: OBSERVABLE SIGNS

Visual clues that suggest possible concussion include:

- Lying motionless on the playing surface
- Disorientation or confusion, or an inability to respond appropriately to questions
- Balance, gait difficulties, motor incoordination, stumbling, slow laboured movements
- Slow to get up after a direct or indirect hit to the head
- Blank or vacant look
- Facial injury after head trauma

STEP 3: SYMPTOMS

- Headache
- Blurred vision
- More emotional
- Difficulty concentrating
- "Pressure in head"
- Sensitivity to light
- More irritable
- Difficulty remembering
- Balance problems
- Sensitivity to noise
- Sadness
- Feeling slowed down
- Nausea or vomiting
- Fatigue or low energy
- Nervous or anxious
- Feeling like "in a fog"
- Drowsiness
- Neck Pain
- "Don't feel right"
- Dizziness

STEP 4: MEMORY ASSESSMENT

(IN ATHLETES OLDER THAN 12 YEARS)

Failure to answer any of these questions (modified appropriately for each sport) correctly may suggest a concussion:

- "What venue are we at today?"
- "What team did you play last week/game?"
- "Which half is it now?"
- "Did your team win the last game?"
- "Who scored last in this game?"

Athletes with suspected concussion should:

- Not be left alone initially (at least for the first 1-2 hours).
- Not drink alcohol.
- Not use recreational/prescription drugs.
- Not be sent home by themselves. They need to be with a responsible adult.
- Not drive a motor vehicle until cleared to do so by a healthcare professional.

The CRT5 may be freely copied in its current form for distribution to individuals, teams, groups and organisations. Any revision and any reproduction in a digital form requires approval by the Concussion in Sport Group. It should not be altered in any way, rebranded or sold for commercial gain.

ANY ATHLETE WITH A SUSPECTED CONCUSSION SHOULD BE IMMEDIATELY REMOVED FROM PRACTICE OR PLAY AND SHOULD NOT RETURN TO ACTIVITY UNTIL ASSESSED MEDICALLY, EVEN IF THE SYMPTOMS RESOLVE

Pillars of Concussion Management Care

1. Cognitive rest
2. Physical rest
3. Hydration
4. Nutrition
5. Sleep



Importance of REST



- Brain's response to concussion is to want to rest
- Rest allows the brain to use available energy to recover
- Rest allows for symptoms to lessen
- Use of energy for other activities will increase symptoms and delay recovery



Cognitive Rest



Limit/ eliminate all non essential cognitive stresses:

- a) No text messaging
- b) No Facebook or other social media
- c) No video games
- d) Limit pleasure reading at least initially
- e) Limit movie theaters or any television that requires thought

Concussion Effects on Learning

- ▶ Concussion can cause mental fatigue and affect ability to participate, learn & perform in school:
 - *Difficulty with new learning*
 - *Decreased attention and memory*
 - *Slowed processing speed and efficiency*
 - *Slowed reaction time*
 - *Anxiety/ nervousness*
 - Can further impair cognitive function & impact compliance
 - *Emotional meltdowns & behavioural outbursts*
 - Common result of mental fatigue
 - Especially in younger children



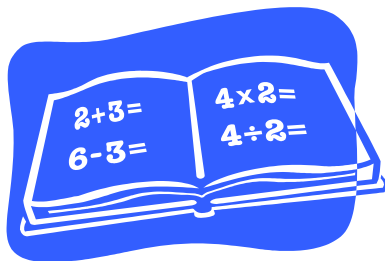
Return to Learn

- Stepwise increase in cognitive tasks
 - *Cognitive rest*
 - *Period of school absence*
 - *Increase cognitive activities at home*
 - *Gradual return to school*
 - Half-days initially, only attend some classes
 - Shortened day → start later in the morning or have an early dismissal depending on student's peak time for symptoms
 - Avoid classes such as physical education, music and industrial arts until symptoms have resolved
 - Teacher reassurance

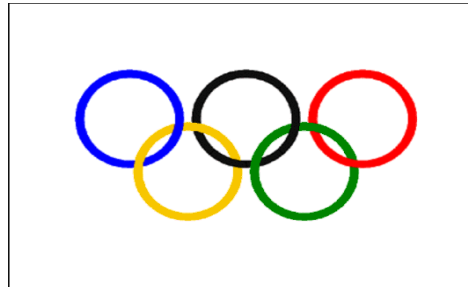


Accommodations in the Classroom

- Math and chemistry seem to cause the return of symptoms more than other classes
 - *This may be because more areas of the brain are used to process the information & more intense concentration required by some students.*



Consensus Statements on Concussion in Sport



Statements based on international conferences among leading concussion experts from around the globe:

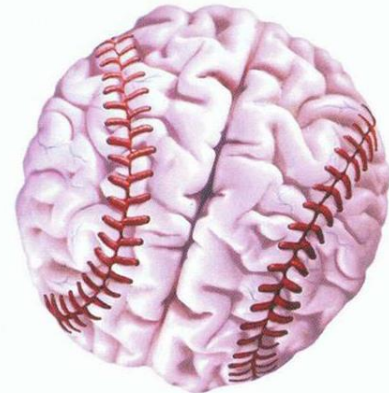
- 1st Vienna in 2001
- 2nd Prague in 2004
- 3rd Zurich 2008
- 4th Zurich 2012
- 5th Berlin 2016





6-Step Graduated Exertion Strategy

- ▶ Return to play protocol initiated when the student no longer has any symptoms
 - *average 7-10 days but varies significantly*
- ▶ Time needed to successfully complete each step will vary with severity of the concussion and the student
- ▶ Each step must be a minimum of one day & medically supervised (more cautious in younger children)
- ▶ If any symptoms return either during the activity or later that day the student must:
 - *Stop all activity immediately*
 - *Rest for 24 hours*
 - *Follow-up with physician or nurse practitioner to determine the next appropriate step*



Consensus Statement on Concussion in Sport

Graduated return-to-sport (RTS) strategy

- Stage 1: Symptom-limited activity
 - *Daily activities that do not provoke symptoms*
 - Goal: Gradual reintroduction of work/ school activities
- Stage 2: Light aerobic exercise
 - *Walking or stationary cycling at slow to medium pace. No resistance training*
 - Goal: Increase heart rate

Consensus Statement on Concussion in Sport

Graduated return-to-sport (RTS) strategy

- Stage 3: Sport-specific exercise
 - *Running or skating drills. No head impact activities*
 - Goal: Add movement
- Stage 4: Non-contact training drills
 - *Harder training drills; eg, passing drills. May start progressive resistance training*
 - Goal: Exercise, coordination and increased thinking



Return to Play

- After successfully completing Step 4, the teacher/coach provides the student with the ***Documentation for a Diagnosed Concussion***
- Student must return for a second visit with the physician/ NP to be reassessed for final approval to engage in full physical activity
- Physician determines and indicates that all symptoms and signs of the concussion are gone by completing:
 - I, _____ (medical doctor/nurse practitioner name) have examined _____ (student name) and confirm he/she continues to be symptom free and is able to return to regular physical education class/intramural activities/interschool activities in non-contact sports and full training/practices for contact sports.
- Physician signs and dates the form and student brings the completed form to the appropriate school personnel



Consensus Statement on Concussion in Sport

Graduated return-to-sport (RTS) strategy

- Stage 5: Full contact practice
 - *Following medical clearance, participate in normal training activities*
 - Goal: Restore confidence and assess functional skills by coaching staff
- Stage 6: Return to sport
 - *Normal game play*



Consensus Statement on Concussion in Sport

Graduated return-to-school strategy

- Stage 1: Daily activities at home that do not give the child symptoms
 - *Typical activities of the child during the day as long as they do not increase symptoms (eg, reading, texting, screen time). Start with 5-15 minutes at a time and gradually build up*
 - Goal: Gradual return to typical activities
- Stage 2: School activities
 - *Homework, reading or other cognitive activities outside of the classroom*
 - Goal: Increase tolerance to cognitive work

Once the student returns to school with the appropriate interventions in place:



1. Are the interventions working?
2. How long do the academic adjustments need to be in place?
3. The process of Assess - Intervene - Monitor progress – Adjust repeats until the student is recovered



Consensus Statement on Concussion in Sport

Graduated return-to-school strategy

- Stage 3: Return to school part-time
 - *Gradual introduction of schoolwork. May need to start with a partial school day or with increased breaks during the day*
 - Goal: Increase academic activities
- Stage 4: Return to school full time
 - *Gradually progress school activities until a full day can be tolerated*
 - Goal: Return to full academic activities and catch up on missed work

CHEO





Concussion Clinic- Opened in November, 2014

1355 Bank St, Suite 111 (Ottawa)

Patients being seen:

- Children who have sustained a head injury (direct or indirect blow to the head) resulting in concussion-like symptoms (e.g. physical, cognitive, emotional or sleep)
- Patients who have remained symptomatic at least 4 weeks after the injury
- 18 years of age or younger



Concussion Clinic- Services

- Symptom and physical assessment
- Diagnosis
- Information about concussions including symptom management strategies
- Plan of care development including:
 - *need for additional testing or imaging*
 - *specialist referral*
 - *Individualized "return-to-learn" and "return-to-play" steps*
- Collaboration with primary care provider and clinic follow-up for as long as deemed necessary



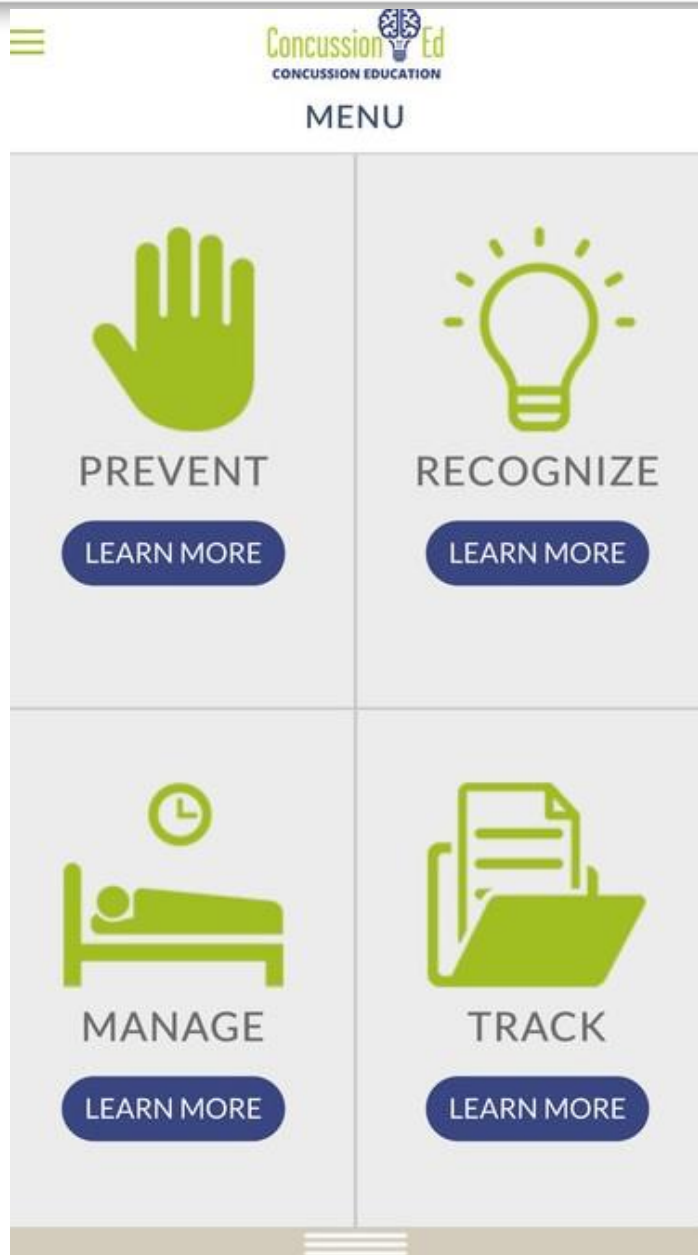
Concussion Clinic- Consults

- Physician should complete Concussion Clinic Referral Form
- Consults should be sent by FAX to: 613-260-3897
 - *Patient demographics and contact information*
 - *Pertinent medical history*
 - *Mental health issues*
 - *Date of injury*
 - *Mechanism of injury*
 - *Previous concussive injuries*
 - *Primary symptoms*



Concussion Clinic- Contact Information

- The concussion clinic is open from 8 am to 4 pm every Friday.
- For administrative questions:
 - [613 260-1477 ext. 221](tel:6132601477)
- For clinical questions:
 - *Gail Macartney, Nurse Practitioner: 613 737-7600 ext. 3396*



thinkfirst



**Use Your Mind
To Protect Your Body!**





ThinkFirst !

Be safe !

