Pediatric Concussions

latest approach to management

Sasha Dubrovsky

MDCM MSc FRCPC

Medical Consultant to MTBI Clinic

Pediatric Emergency Medicine

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Overview

- Concussion
  - When to worry
  - Brain rest
  - When to refer
- Post-traumatic headache
  - Occipital nerve blocks

Case study

- 14 year old soccer injury
- Stunned x 5 minutes
- Headache persists x 24 hours

Concussion

Consensus statement on concussion in sports, 4th international conference, Zurich, 2012

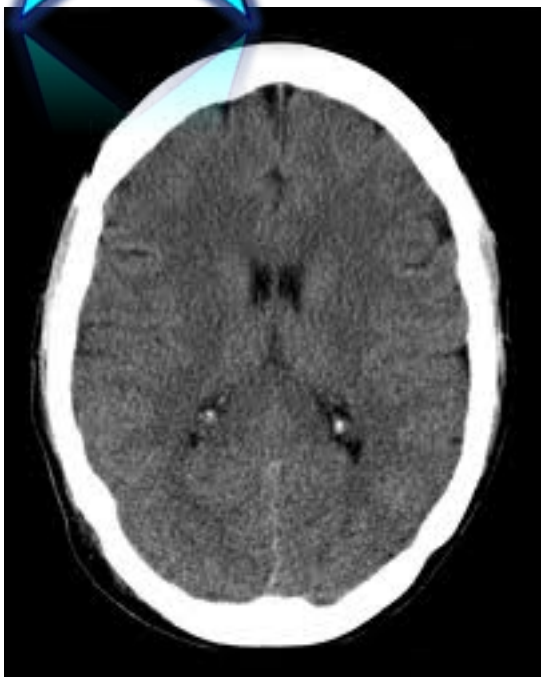
McCrory et al. 2013

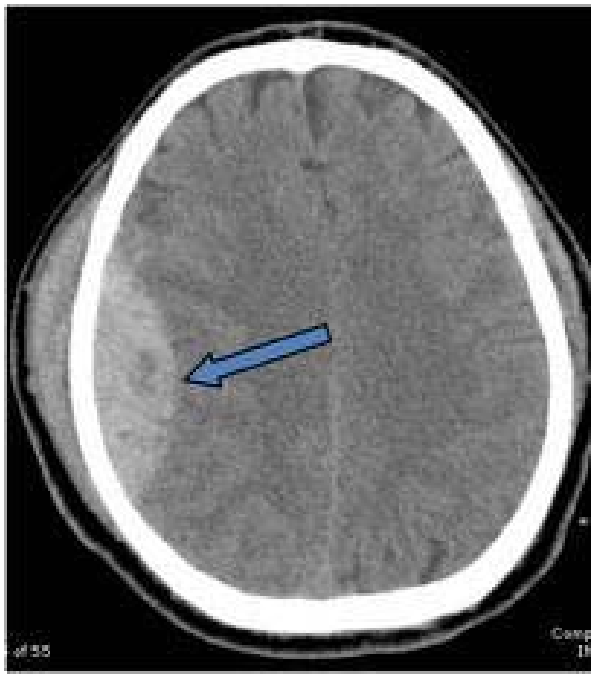
Concussion

- Brain injury … a subset of mild traumatic brain injury (mTBI)

Spectrum of TBI

Mild **Moderate** **Severe**

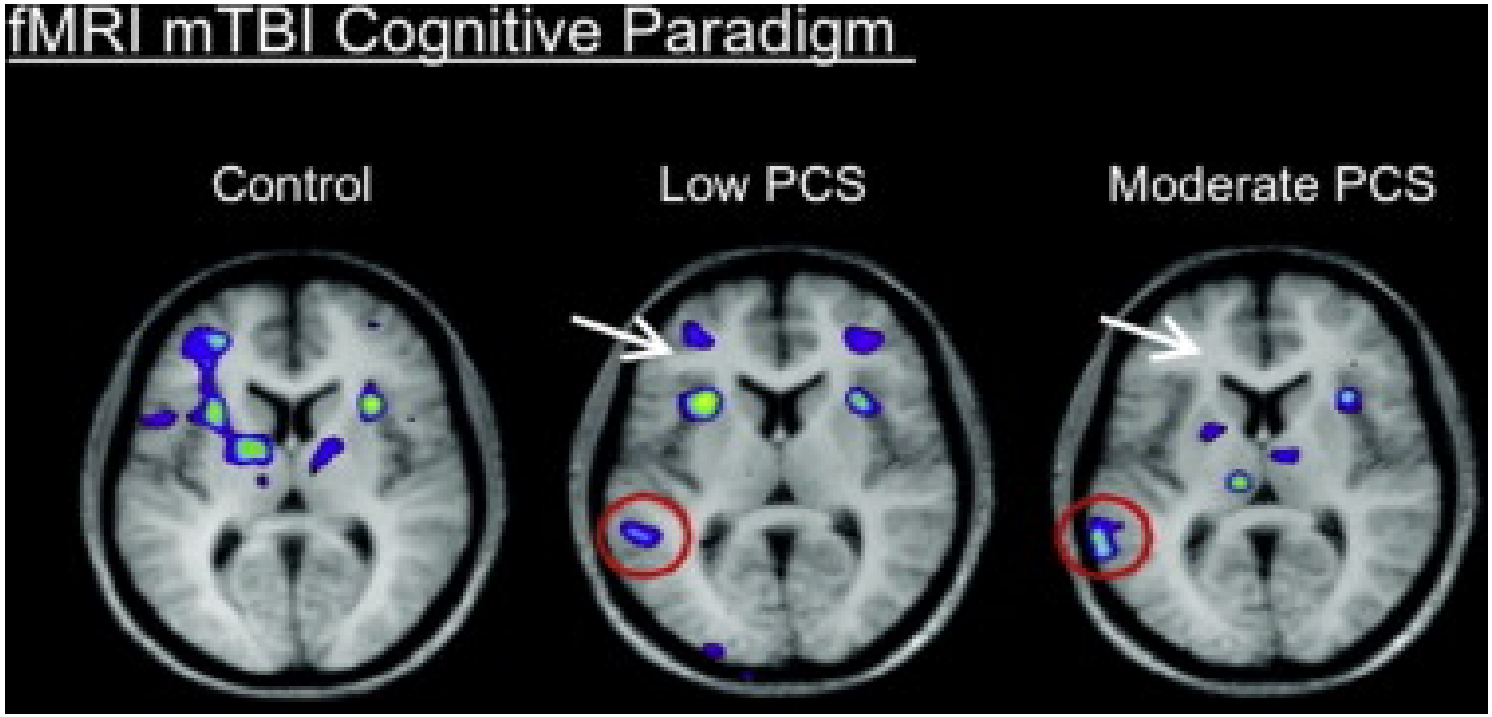




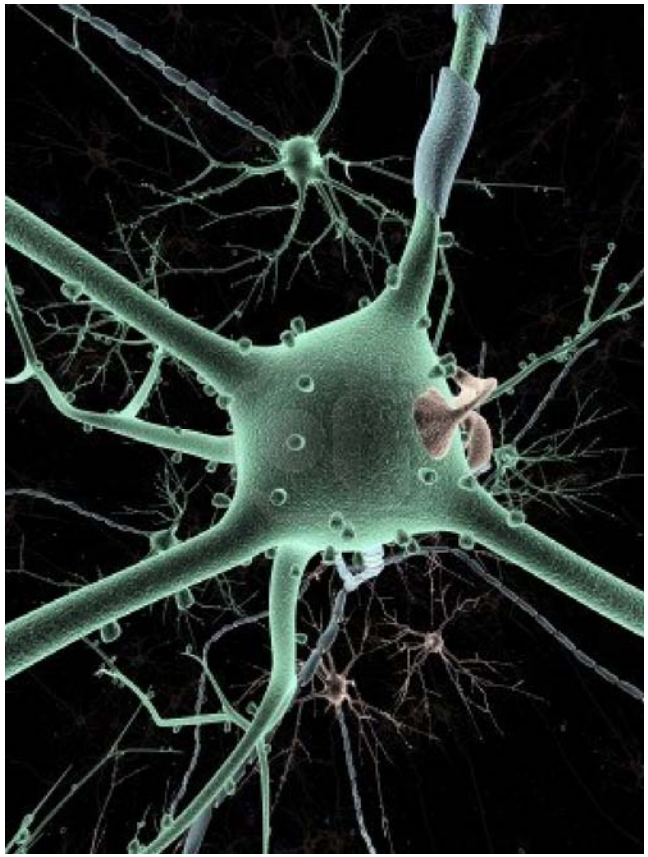
Concussion

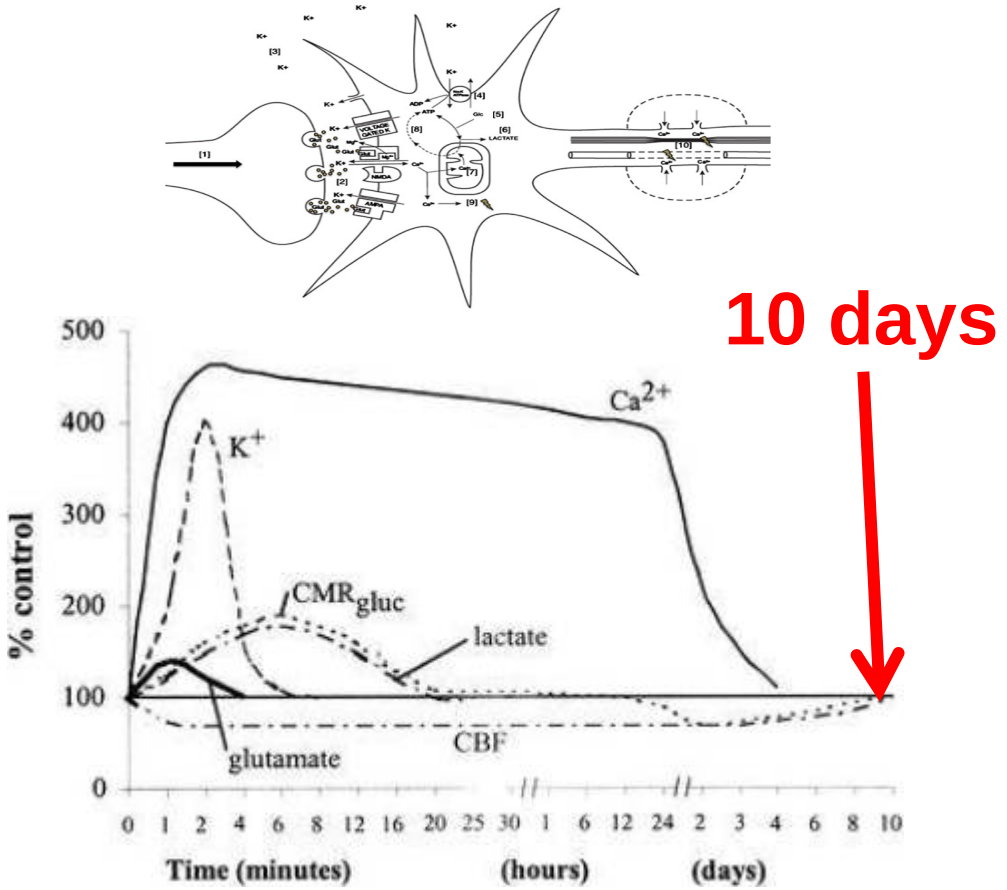
- Brain injury … a subset of mild traumatic brain injury
- Complex pathophysiologic process with a functional disturbance

Functional MRI



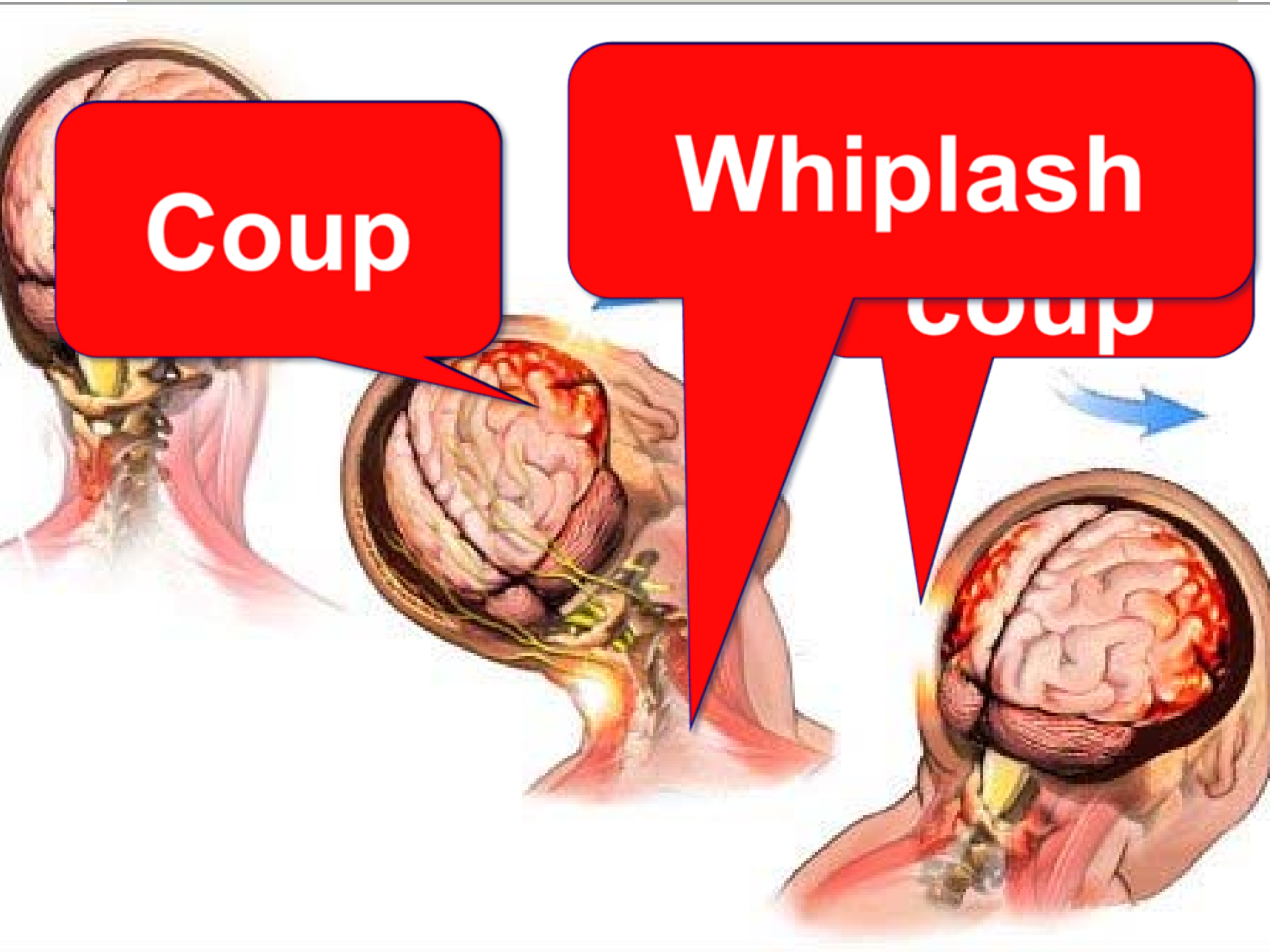
Pathophysiology





Concussion

- Brain injury … a subset of mild traumatic brain injury
- Complex pathophysiologic process … functional disturbance
- Induced by biomechanical forces
  - Direct blow to head or elsewhere with "impulsive" force to head


Coup
Whiplash

Concussion

- Rapid onset of short-lived impairment in neurologic function
- … albeit may evolve over hours
- ± loss of consciousness

Concussion

- Recovery usually within 2-3 weeks
- Pediatric often longer …

  55% symptomatic at 1 month

  14% symptomatic at 3 months

  2% symptomatic at 12 months

Management Goals

- Diagnosis
- Minimize likelihood for post-concussion syndrome and/or 2nd injuries
- Target therapies to improve speed and magnitude of recovery

Acute injury

- Basic trauma assessment
  - ABCDE
  - Life threatening injuries
    - Focal neurologic findings
    - Glasgow coma scale < 14

On the field

- Loss of consciousness (LOC)
- Balance/motor incoordination
- Confusion
- Amnesia
- Blank/vacant look

Maddock's questions

"I am going to ask you a few questions"

- Where are we at now?
- Is it before or after lunch?
- What did you have last class?
- What is your teacher's name?

Return to play = NO

Acute injury

- Basic trauma assessment
  - ABCDE → life threatening injuries
- Serial observation
  - Appearance of symptoms might be delayed hours → evolving injury acutely

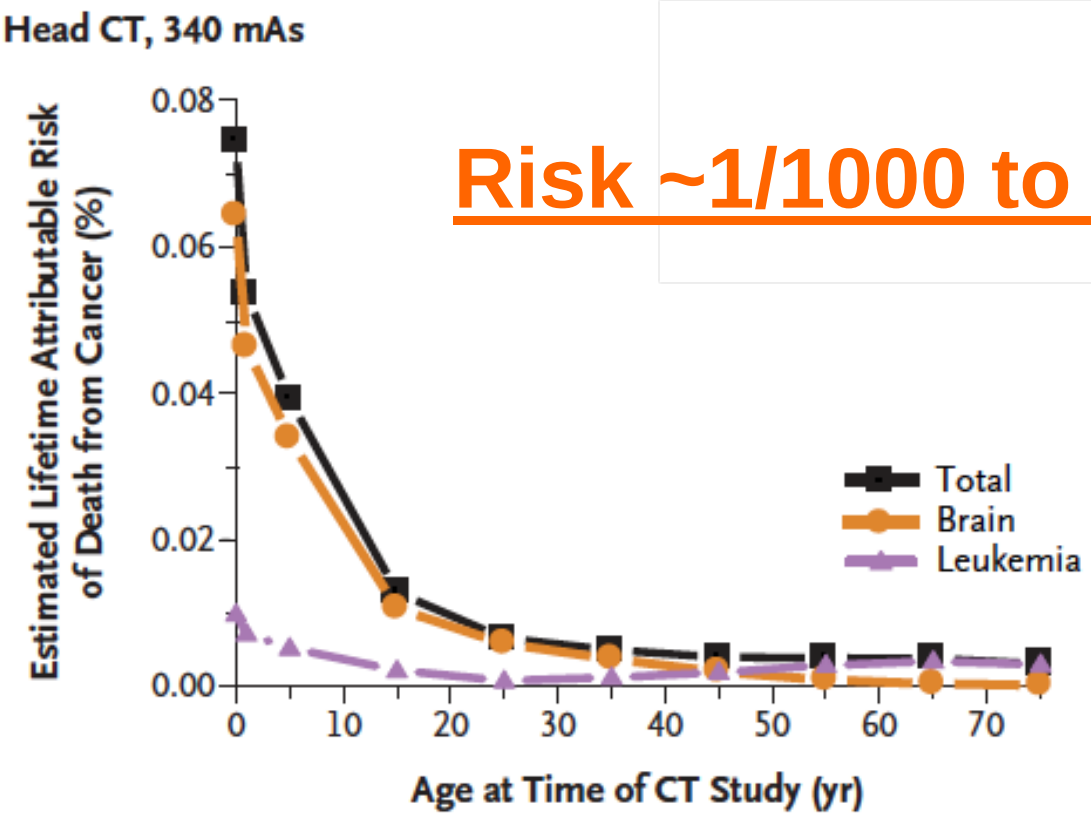
In the emergency department (ED)

In the ED

- Goal #1: red flags for injury
  - Is there an intra-cranial bleed?
  - Is there a cervical spine injury?

Risk versus benefit

CT and radiation



Risk ~1/1000 to 1/5000

When to image?

- CATCH
- PECARN

} r/o intra-cranial bleed

Red flags

- GCS < 15
- Worsening headache
- Worsening vomiting
- Irritable
- Severe mechanisms
- Suspected skull fracture
  (basal, depressed, open)

Tincture of time

- Evolution of symptoms and signs since injury

Canadian Pediatric Society

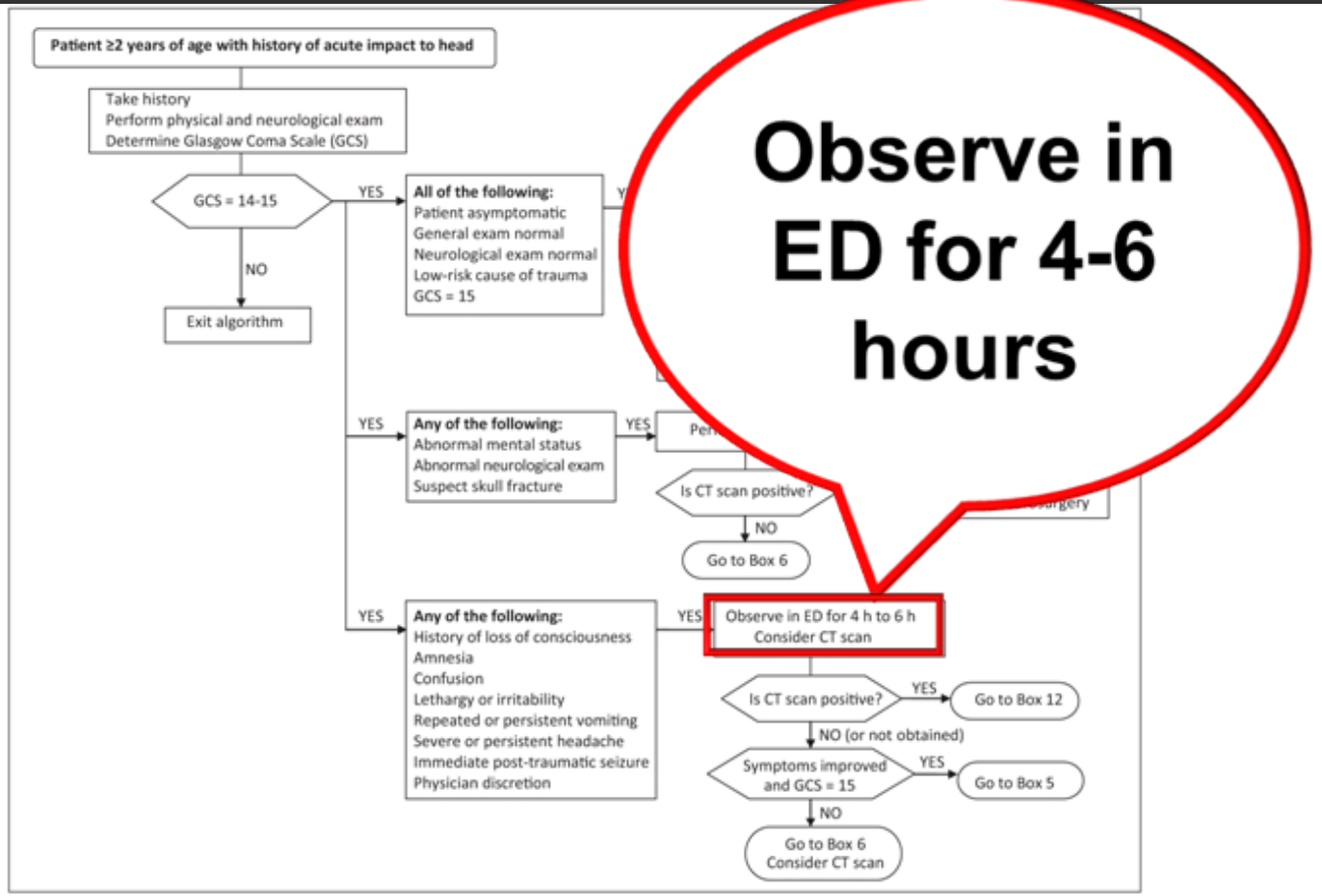


Figure 1) *Algorithm for the management of the paediatric patient ≥2 years of age with minor head trauma. CT Computed tomography; ED Emergency department*

When to image?

- CATCH
- PECARN

} r/o intra-cranial bleed

- NEXUS

} r/o cervical spine injury

In the ED

- Goal #1: Red flags for injury
  - Is there an intra-cranial bleed?
  - Is there a cervical spine injury?
- Goal #2: Diagnosis
  - Does this patient have a concussion?

Acute Concussion

- Symptoms — ex. headache, nausea
- Signs — ex. loss of consciousness, pallor
- Behaviors — ex. irritable, emotionally labile
- Cognitive — ex. “foggy”/slow, confusion, amnesia
- Sleep — ex. fatigue, insomnia

Diagnostic criteria

Any one or more:

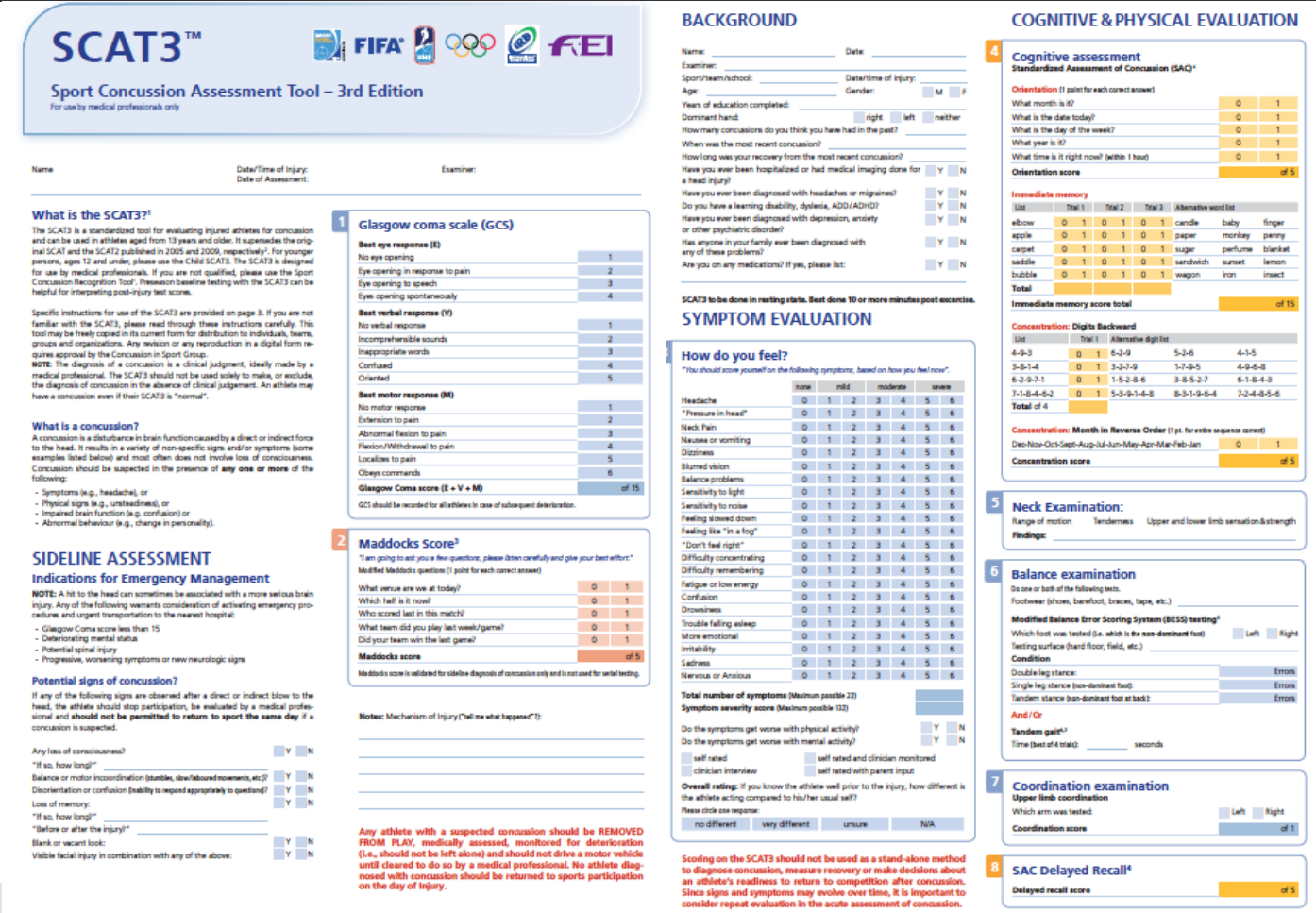
- Initial obvious signs
(LOC, convulsion, gait unsteadiness)
- Observer reports “off”
(cognitive, behavior, emotion)
- Patient reports symptoms on concussion
- Abnormal neurocognitive and/or balance exam

(McCrory et al. 2013)

Assessment includes:

- Mental status
- Cognitive functioning
- Neurologic exam
- Gait
- Balance

Standardized concussion assessment tool (SCAT3 & Child SCAT3)



SCAT3™

Sport Concussion Assessment Tool – 3rd Edition

For use by medical professionals only

Name | Date/Time of Injury: Date of Assessment: | Examiner:

What is the SCAT3?[1]

The SCAT3 is a standardized tool for evaluating injured athletes for concussion and can be used in athletes aged from 13 years and older. It supersedes the original SCAT and the SCAT2 published in 2005 and 2009, respectively[2]. For younger persons, ages 12 and under, please use the Child SCAT3. The SCAT3 is designed for use by medical professionals. If you are not qualified, please use the Sport Concussion Recognition Tool[3]. Preseason baseline testing with the SCAT3 can be helpful for interpreting post-injury test scores.

Specific instructions for use of the SCAT3 are provided on page 3. If you are not familiar with the SCAT3, please read through these instructions carefully. This tool may be freely copied in its current form for distribution to individuals, teams, groups and organizations. Any revision or any reproduction in a digital form requires approval by the Concussion in Sport Group.

NOTE: The diagnosis of a concussion is a clinical judgment, ideally made by a medical professional. The SCAT3 should not be used solely to make, or exclude, the diagnosis of concussion in the absence of clinical judgement. An athlete may have a concussion even if their SCAT3 is "normal".

What is a concussion?

A concussion is a disturbance in brain function caused by a direct or indirect force to the head. It results in a variety of non-specific signs and/or symptoms (some examples listed below) and most often does not involve loss of consciousness. Concussion should be suspected in the presence of **any one or more** of the following:

- Symptoms (e.g., headache), or
- Physical signs (e.g., unsteadiness), or
- Impaired brain function (e.g. confusion) or
- Abnormal behaviour (e.g., change in personality).

SIDELINE ASSESSMENT

Indications for Emergency Management

NOTE: A hit to the head can sometimes be associated with a more serious brain injury. Any of the following warrants consideration of activating emergency procedures and urgent transportation to the nearest hospital:

- Glasgow Coma score less than 15
- Deteriorating mental status
- Potential spinal injury
- Progressive, worsening symptoms or new neurologic signs

Potential signs of concussion?

If any of the following signs are observed after a direct or indirect blow to the head, the athlete should stop participation, be evaluated by a medical professional and **should not be permitted to return to sport the same day** if a concussion is suspected.

Any loss of consciousness? Y N

"If so, how long?"

Balance or motor incoordination (stumbles, slow/laboured movements, etc.)? Y N

Disorientation or confusion (inability to respond appropriately to questions)? Y N

Loss of memory: Y N

"If so, how long?"

"Before or after the injury?"

Blank or vacant look: Y N

Visible facial injury in combination with any of the above: Y N

1 Glasgow coma scale (GCS)

Best eye response (E)	
No eye opening	1
Eye opening in response to pain	2
Eye opening to speech	3
Eyes opening spontaneously	4
Best verbal response (V)	
No verbal response	1
Incomprehensible sounds	2
Inappropriate words	3
Confused	4
Oriented	5
Best motor response (M)	
No motor response	1
Extension to pain	2
Abnormal flexion to pain	3
Flexion/Withdrawal to pain	4
Localizes to pain	5
Obeys commands	6
Glasgow Coma score (E + V + M)	of 15

GCS should be recorded for all athletes in case of subsequent deterioration.

2 Maddocks Score[3]

"I am going to ask you a few questions, please listen carefully and give your best effort."

Modified Maddocks questions (1 point for each correct answer)

What venue are we at today?	0	1
Which half is it now?	0	1
Who scored last in this match?	0	1
What team did you play last week/game?	0	1
Did your team win the last game?	0	1
Maddocks score		of 5

Maddocks score is validated for sideline diagnosis of concussion only and is not used for serial testing.

Notes: Mechanism of Injury ("tell me what happened"?):

Any athlete with a suspected concussion should be REMOVED FROM PLAY, medically assessed, monitored for deterioration (i.e., should not be left alone) and should not drive a motor vehicle until cleared to do so by a medical professional. No athlete diagnosed with concussion should be returned to sports participation on the day of injury.

BACKGROUND

Name: Date:

Examiner:

Sport/team/school: Date/time of injury:

Age: Gender: M F

Years of education completed:

Dominant hand: right left neither

How many concussions do you think you have had in the past?

When was the most recent concussion?

How long was your recovery from the most recent concussion?

Have you ever been hospitalized or had medical imaging done for a head injury? Y N

Have you ever been diagnosed with headaches or migraines? Y N

Do you have a learning disability, dyslexia, ADD/ADHD? Y N

Have you ever been diagnosed with depression, anxiety or other psychiatric disorder? Y N

Has anyone in your family ever been diagnosed with any of these problems? Y N

Are you on any medications? If yes, please list: Y N

SCAT3 to be done in resting state. Best done 10 or more minutes post exercise.

SYMPTOM EVALUATION

How do you feel?

"You should score yourself on the following symptoms, based on how you feel now."

	none	mild		moderate		severe	
Headache	0	1	2	3	4	5	6
"Pressure in head"	0	1	2	3	4	5	6
Neck Pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like "in a fog"	0	1	2	3	4	5	6
"Don't feel right"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
Trouble falling asleep	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or Anxious	0	1	2	3	4	5	6
Total number of symptoms (Maximum possible 22)							
Symptom severity score (Maximum possible 132)							

Do the symptoms get worse with physical activity? Y N

Do the symptoms get worse with mental activity? Y N

self rated self rated and clinician monitored

clinician interview self rated with parent input

Overall rating: If you know the athlete well prior to the injury, how different is the athlete acting compared to his/her usual self?

Please circle one response:

no different | very different | unsure | N/A

Scoring on the SCAT3 should not be used as a stand-alone method to diagnose concussion, measure recovery or make decisions about an athlete's readiness to return to competition after concussion. Since signs and symptoms may evolve over time, it is important to consider repeat evaluation in the acute assessment of concussion.

COGNITIVE & PHYSICAL EVALUATION

4 Cognitive assessment

Standardized Assessment of Concussion (SAC)[4]

Orientation (1 point for each correct answer)

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1
What time is it right now? (within 1 hour)	0	1
Orientation score		of 5

Immediate memory

List	Trial 1	Trial 2	Trial 3	Alternative word list		
elbow	0 1	0 1	0 1	candle	baby	finger
apple	0 1	0 1	0 1	paper	monkey	penny
carpet	0 1	0 1	0 1	sugar	perfume	blanket
saddle	0 1	0 1	0 1	sandwich	sunset	lemon
bubble	0 1	0 1	0 1	wagon	iron	insect
Total						
Immediate memory score total						of 15

Concentration: Digits Backward

List	Trial 1	Alternative digit list		
4-9-3	0 1	6-2-9	5-2-6	4-1-5
3-8-1-4	0 1	3-2-7-9	1-7-9-5	4-9-6-8
6-2-9-7-1	0 1	1-5-2-8-6	3-8-5-2-7	6-1-8-4-3
7-1-8-4-6-2	0 1	5-3-9-1-4-8	8-3-1-9-6-4	7-2-4-8-5-6
Total of 4				

Concentration: Month in Reverse Order (1 pt. for entire sequence correct)

Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan	0	1
Concentration score		of 5

5 Neck Examination:

Range of motion Tenderness Upper and lower limb sensation & strength

Findings:

6 Balance examination

Do one or both of the following tests.

Footwear (shoes, barefoot, braces, tape, etc.)

Modified Balance Error Scoring System (BESS) testing[5]

Which foot was tested (i.e. which is the non-dominant foot) Left Right

Testing surface (hard floor, field, etc.)

Condition | Errors

Double leg stance:

Single leg stance (non-dominant foot):

Tandem stance (non-dominant foot at back):

And / Or

Tandem gait[4,5]

Time (best of 4 trials): seconds

7 Coordination examination

Upper limb coordination

Which arm was tested: Left Right

Coordination score of 1

8 SAC Delayed Recall[4]

Delayed recall score of 5

Neurologic exam

- Level of consciousness
- Pupil reactivity
- Extra-ocular movements
- Gross motor
- Coordination
- Gait

Diagnostic criteria

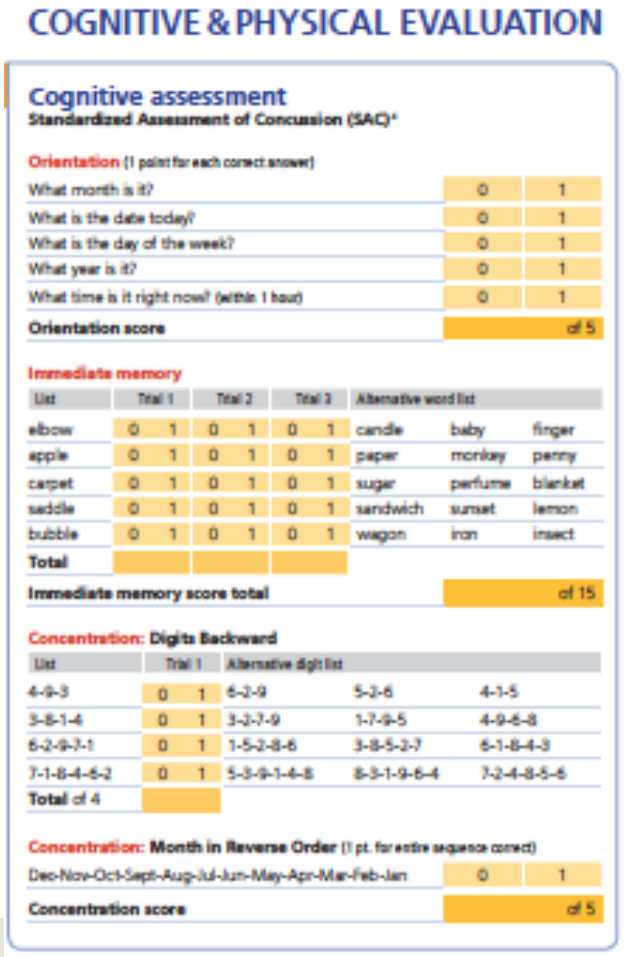
Any one or more:

- Initial obvious signs
(LOC, convulsion, gait unsteadiness)
- Observer reports “off”
(cognitive, behavior, emotion)
- Patient reports symptoms on concussion
- Abnormal neurocognitive and/or balance exam

(McCrory et al. 2013)

Cognitive assessment

- Orientation
- Immediate memory
- Concentration
- Delayed memory



COGNITIVE & PHYSICAL EVALUATION

Cognitive assessment
Standardized Assessment of Concussion (SAC)*

Orientation (1 point for each correct answer)

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1
What time is it right now? (within 1 hour)	0	1
Orientation score		of 5

Immediate memory

List	Trial 1	Trial 2	Trial 3	Alternative word list		
elbow	0 1	0 1	0 1	candle	baby	finger
apple	0 1	0 1	0 1	paper	monkey	penny
carpet	0 1	0 1	0 1	sugar	perfume	blanket
saddle	0 1	0 1	0 1	sandwich	sunset	lemon
bubble	0 1	0 1	0 1	wagon	iron	insect
Total						
Immediate memory score total						of 15

Concentration: Digits Backward

List	Trial 1	Alternative digit list		
4-9-3	0 1	6-2-9	5-2-6	4-1-5
3-8-1-4	0 1	3-2-7-9	1-7-9-5	4-9-6-8
6-2-9-7-1	0 1	1-5-2-8-6	3-8-5-2-7	6-1-8-4-3
7-1-8-4-6-2	0 1	5-3-9-1-4-8	8-3-1-9-6-4	7-2-4-8-5-6
Total of 4				

Concentration: Month in Reverse Order (1 pt. for entire sequence correct)

Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan	0	1
Concentration score		of 5

Balance

Balance error scoring system (BESS)

Diagnosis = Concussion

…*now what*

Brain Rest

Headache Management (1st weeks)

- Rest
- Ibuprofen x 3 days
  - Limit 3 days / week → rebound
- Severe pain
  - Maxeran IV, 0.5 mg/kg
    (max 10 mg/dose)
  - May repeat x 3

Graded Return

- School
- Sports

Back to case

- Assessment
- Reassurance
- Counseling
- Written documentation
- MD notes for school/sports

01

Where kids come first

Mild traumatic brain injury

L'Hôpital de Montréal pour enfants
The Montreal Children's Hospital
Centre universitaire de santé McGill
McGill University Health Centre

TRAUMATOLOGIE
www.hopitalpourenfants.com/trauma

TRAUMA
www.thechildren.com/trauma

A mild traumatic brain injury (MTBI), also referred to as a concussion, is a disturbance in brain function that can be caused by a blow to the head, jaw, face, neck or body.

The following information is geared towards children and teenagers.

Common causes of an MTBI

- falls from a height at home (beds, changing tables, high chairs, stairs)
- falls at a playground or at school
- sports or recreational activities
- motor vehicle collisions (passenger, driver, pedestrian or cyclist)
- violent acts

Common signs and symptoms of an MTBI

- headache
- nausea and vomiting
- dizziness
- loss of consciousness
- feeling dazed and confused
- memory loss
- poor balance or coordination
- drowsiness
- irritability
- agitation
- fatigue

Your child or teenager has been examined and can return home at this time. However, certain symptoms may appear within 72 hours following the injury. If any of the following develop, seek medical attention at an emergency department immediately:

- **Increasing headache, especially if localized**
- **Persistent vomiting**
- **One pupil becoming larger than the other**
- **Behavioural changes (persistent irritability in younger children; increased agitation in teens)**
- **Excessive drowsiness (difficult to arouse)**
- **Difficulty seeing, hearing, speaking or walking**
- **Seizure**
- **Confusion or disorientation (does not recognize people or places)**

Mi
bra

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- **Difficulty seeing, hearing, speaking or walking**
- **Seizure**
- **Confusion or disorientation (does not recognize people or places)**

What to expect following an MTBI?

Signs and symptoms following an MTBI usually last 1 – 2 weeks but may occasionally last longer. **Frequently reported are:** headache, dizziness, nausea, sleep disturbances, fatigue, irritability and restlessness, sensitivity to light, sound and motion, difficulty with memory, concentration, attention span, judgment or balance.

It is very important to allow a child or teenager to rest both physically and cognitively until he/she is fully symptom-free. This reduces the chance of developing persistent symptoms.

Restrictions and recommendations for school and other activities during the recovery period:

- Inform day-care, school personnel and coaches of the MTBI and the restrictions
- Return to school gradually; half days for the first few days and increase to full days as tolerated
- No academic exams, tests, quizzes, projects or oral presentations during the first two weeks
- No gym, playground, sports or other strenuous activities
- Do not attend sport practices as they may interfere with the resting period
- Do not attend music classes or lessons, drama classes or dance classes
- Supervised leisure swimming is permitted; no diving or jumping
- Adequate rest and breaks are encouraged
- Limit time spent on video games and computers, texting, watching television and playing musical instruments as these activities may provoke headaches
- Allow students to bring a bottle of water to the class; dehydration may provoke headaches

Additional recommendations for teenagers

- Avoid going to parties and movies, excessive noise and lights may provoke headaches
- Absolutely no drugs or alcohol
- Avoid driving until symptoms have resolved

Complete resolution from MTBI related symptoms is essential before returning to activities. This reduces the chance of having another MTBI with increased and prolonged symptoms.

If symptoms have not resolved in approximately 2 weeks following the MTBI, further consultation by the Neurotrauma/MTBI Program is recommended.

Please call 514-412-4400 x 23310.

The child or teenager must be completely symptom free at rest for one week prior to resuming physical activity. At that point, gradual return to physical activity over a few days is recommended.

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It is very important to allow a child or teenager to rest both physically and cognitively until he/she is fully symptom-free. This reduces the chance of developing persistent symptoms.

- Inform day-care, school personnel
  of the MTBI and the rest
- Return to scho
  few days
- No
- Avoid driving until symptoms have resolved

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TBI with increased

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REST

Restrictions and recommendations for school and other activities during the recovery period:

- Inform day-care, school personnel and coaches of the MTBI and the restrictions
- Return to school gradually; half days for the first few days and increase to full days as tolerated
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Return to learn

Attendance Restrictions: No school for 2 days then progress to:

- Half-days to full days as tolerated
- Allow for late arrival or early departure

Testing: No testing for a minimum of two weeks

Students who have sustained a concussion can experience an increase in memory and attention problems. Highly demanding activities such as testing can significantly increase these symptoms and cause headaches and fatigue subsequently making testing more difficult. While the student is symptomatic, it is recommended that he/she have:

Workload reduction:

A concussed student may require more time to complete assignments due to an increase in memory problems and decreased speed of processing. It is therefore recommended to reduce the cognitive load, which may include reducing homework during the first week, and allocating additional time for projects and assignments.

- allow breaks as needed in order to control symptom levels (i.e. test for an entire period in between classes as needed)

When the student is symptom-free for one consecutive week, a gradual approach to testing is important:

- Additional time to complete tests
- Allow testing across multiple sessions
- Open book/take home tests when possible
- Reformat from free response to multiple choice
- Testing in a quiet environment
- Reduced length of tests
- Allow 1-2 days between tests

Emergency Department MD Signature: _____

For more information: http://www.thechildren.com/trauma/_pdf/en/trauma-concussion-flyer.pdf

H:\Public\Protocols and forms\Academic Recommendations Rev. Sept 2013

Return to learn

Return to sports

Returning to physical activity and sports following an MTBI

If your child or teenager plays organized sports, have him/her follow these progressive steps before returning to play.

There should be approximately 24 hours in between each step. If any symptoms return at any time during this action plan, stop working out. Rest until you are symptom-free for 24 hours, then return to the previous step. If symptoms do not resolve or get worse, seek medical attention.

STEP 1 Light general conditioning exercises

- NO CONTACT.
- Begin with a warm up (stretching/flexibility) for 5-10 minutes.
- Start a cardio workout of 15-20 minutes which can include: stationary bicycle, treadmill, fast paced walking, light jog, rowing or swimming.

STEP 2 General conditioning and sport specific skill work done *individually*

- NO CONTACT.
- Begin with a warm up (stretching/flexibility) for 5-10 minutes.
- Increase intensity and duration of cardio workout to 20-30 minutes.
- Begin sport specific skill work within the workout, but no spins, dives or jumps.

STEP 3 General conditioning, skill work done *individually and with a team-mate*

- NO CONTACT.
- Increase duration of session to 60 minutes. Begin resistance training.
- Continue practicing sport specific individual skills.
- May begin general shooting, kicking or passing drills with a partner.
- Start beginner level spins, dives and jumps.

STEP 4 General conditioning, skill work and *team drills*

- NO CONTACT. NO SCRIMMAGES.
- Resume pre-injury duration of practice and team drills.
- Increase resistance training and skill work as required.
- Gradually increase skill level of spins, dives and jumps.

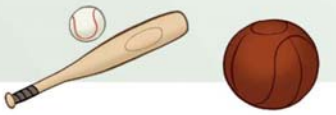
STEP 5 Full practice *with body contact*

- CONTACT. SCRIMMAGES.
- Participate in full practice to get yourself back in the lineup. **If completed with no symptoms**, discuss with the coach about getting back in the game.
- Coaches must make sure that the athlete has regained his/her pre-injury skill-level and is confident in his/her ability to return to activity.

STEP 6 Return to competition!

PREVENTION TIPS

- **Wear appropriate standardized protective equipment. Make sure it fits.**
- **Wearing a helmet decreases the severity of brain injuries.**
- **Participate in activities that are appropriate for your age and skill level.**
- **Physical preparation, proper conditioning and skill training is fundamental.**
- **Fair play which includes teamwork, sportsmanship, respecting the rules and zero tolerance to violence is essential.**
- **Never play through an injury. Seek medical attention early on and follow the recommendations.**



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Returning to physical activity and sports following an MTBI

If your child or teenager plays organized sports, have him/her

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- Start beginner level spins, dives and jumps.

Seek medical attention and follow the recommendations.

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CONCUSSION KIT POUR LES COMMOTIONS CÉRÉBRALES

L'Hôpital de Montréal pour enfants
The Montreal Children's Hospital
Centre universitaire de santé McGill
McGill University Health Centre

REPRENDRE LE SOCCER APRÈS UNE COMMOTION CÉRÉBRALE

Si vous avez subi une commotion cérébrale, il est recommandé de suivre cette stratégie de retour au jeu avant de remettre votre chandail d'équipe.

Vous devez respecter toute la période de repos recommandée et suivre les restrictions imposées. Souvenez-vous que vous ne devez songer à reprendre vos activités que si vous n'avez pas de symptômes au repos depuis au moins une semaine. Lorsque vous êtes prêt à revenir au jeu, suivez ces étapes en y allant progressivement.

Il doit s'écouler au moins 24 heures entre chaque étape. Si vous éprouvez de nouveau des symptômes durant cette remise en forme, cessez toute activité. Reposez-vous jusqu'à ce que vous n'ayez plus de symptômes durant 24 heures, puis reprenez à l'étape précédente. Si les symptômes ne se résolvent pas ou s'aggravent, vous devez consulter un médecin sans tarder.

★ ÉTAPE 1 : Légers exercices de conditionnement
- Commencer par 5 à 10 minutes d'exercices d'échauffement (étirements/flexibilité);
- Enchaîner avec 15 à 20 minutes d'entraînement pouvant comporter : vélo stationnaire, tapis roulant, marche rapide, course légère, aviron ou natation.

★ ÉTAPE 2 : Conditionnement et habiletés spécifiques au sport; individuellement
- Commencer par 5 à 10 minutes d'exercices d'échauffement (étirements/flexibilité);
- Augmenter l'intensité et la durée de l'entraînement (20 à 30 minutes);
- Commencer les exercices d'habileté spécifiques au soccer : course, dribles statiques et dynamiques avec les cônes, et coups de pied.

★ ÉTAPE 3 : Conditionnement et habiletés spécifiques au sport; individuellement et avec un coéquipier
- AUCUN CONTACT;
- Augmenter la durée de la séance d'entraînement à 60 minutes. Commencer l'entraînement en résistance;
- Commencer les exercices avec un partenaire : dribles, passes et lancers sur le gardien;
- Commencer à revoir les stratégies de jeu en attaque et en défense au ralenti.

★ ÉTAPE 4 : Conditionnement et habiletés spécifiques au sport; en équipe
- AUCUN CONTACT. AUCUNE MÊLÉE;
- Reprendre les pratiques et les durées d'entraînement habituelles;
- Pratiquer les passes et les lancers en équipe, et revoir les tactiques en défensive, en attaque et en contre-attaque.

★ ÉTAPE 5 : Pratique complète avec contact physique
- Revoir et pratiquer les techniques de jeu de tête;
- Reprendre l'entraînement complet pour retrouver votre place dans l'alignement. Si vous arrivez à la fin d'un entraînement sans symptômes, vous êtes prêt pour un retour à la compétition. Discutez avec l'entraîneur de votre retour au jeu;
- Les entraîneurs doivent s'assurer que l'athlète est revenu à son niveau de jeu habituel et qu'il a confiance en ses moyens pour reprendre le jeu.

★ ÉTAPE 6 : Retour à la compétition

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When to refer

- Worsening/concerning symptoms
- Persistent symptoms (> 10 days)
- Prolonged LOC (> 1 minute)
- Elite athletes (> 6 hours/week)
- Multiple concussions
- Risk factors
  - Migraine, premorbid conditions

MCH Trauma Program's MTBI Clinic

- Team with clinical expertise
- Comprehensive and proactive approach
- Evidence-based

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MCH's MTBI CLINIC

- Inter-professional approach

Novel management strategies

- Active rehabilitation at 1 month

Medical consultant to MTBI clinic

- Confirm diagnosis

"I just wanted to confirm the diagnosis you made at the cocktail party."

http://www.condenaststore.com By Frank Cotham (# 8479643)

Medical consultant to MTBI clinic

- Confirm diagnosis
- Establish a patient-centered plan

Headache

Novel management strategies

- Tailored headache management
  - Migraine action plan
  - Out-patient maxeran IV
  - Peripheral nerve blocks

Acute Head Injury

Check for red flags:
- Altered mental status
- Focal neurological symptoms or deficits
- Progressively worsening headache pattern
- Intractable headache
- Thunderclap headaches
- Headaches induced by position or vasalva maneuver
- Headaches with atypical features failing to conform to common headache phenotype
- Fever or other constitutional symptoms
- Persistent rhinorrhea (possible CSF leak)

Diagnose concussion/mild TBI
1. Symptoms—somatic (ex, headache), cognitive (ex, feeling like in a fog) and/or emotional symptoms (ex, lability);
2. Physical signs (ex, loss of consciousness (LOC), amnesia);
3. Behavioural changes (ex, irritability);
4. Cognitive impairment (ex, slowed reaction times);
5. Sleep disturbance (ex, insomnia)[1]

Counsel + give written instructions:

1. "Brain Rest"
- Cognitive
- Physical

2. Graded Return
- School
- Play/sports

Montreal Children's Hospital Concussion Kit
http://trauma.thechildren.com/trauma/en/treating/injuries/news.aspx?id=404

Headache Management

Box A
- Encourage rest
- NSAIDs at appropriate dose (ex. Ibuprofen) every 6 hours as needed for 3-5 days. Then no more than 2-3 days/week
- Avoid opioids

Box B
- If severe pain (>6/10), acute abortive therapy

Ex. Maxeran IV (may repeat x 3 doses), or prochlorperazine IV

Box C
- As per Box A and ensure not using >2-3 days week
- If migraine features and NSAIDs not effective, consider trial of triptan. (ex. Axert, Maxalt)
- Consider acute abortive therapy if moderate/severe pain (see Box B)

Box D

Box E
- Keep headache diary
- Lifestyle modifications; balanced diet & avoid skipping meals, hydration, and sleep hygiene (5-6 hrs/night restorative sleep)
- Consider biofeedback or other behavioral therapies

Box F

If concussion symptoms persist after approximately 2 weeks, refer to inter-disciplinary concussion program

Box G
- Trial of acute abortive therapy (see Box B)
- Consider short course of steroids, especially if medication overuse
- Consider option(s) in Box C not yet tried. Note that if triptan tried without effect, try alternate
- Address lifestyle issues (Box E)
- Identify and treat comorbidities (ex

Box H

Start prophylaxis or try an alternate medication if previous 2-3 month trial was ineffective at target dose or maximum tolerated dose:
- Elavil
- Gabapentin
- Topamax
- Melatonin if insomnia

If not improving, refer to neurology

At each visit, reassess for headache red flags for structural traumatic brain/spine injury. If concern, obtain MRI over CT if possible.

Outpatient headache management

Abortive

Maxalt	**Ages 6-17**	**5-10 mg (40 lbs)**
Axert	**Ages 12-17**	**12.5 mg**

Prophylaxis

Vitamin B2	**200-400 mg**	**Once daily**
Amitriptyline	**10 mg**	**Every evening**

Insomnia

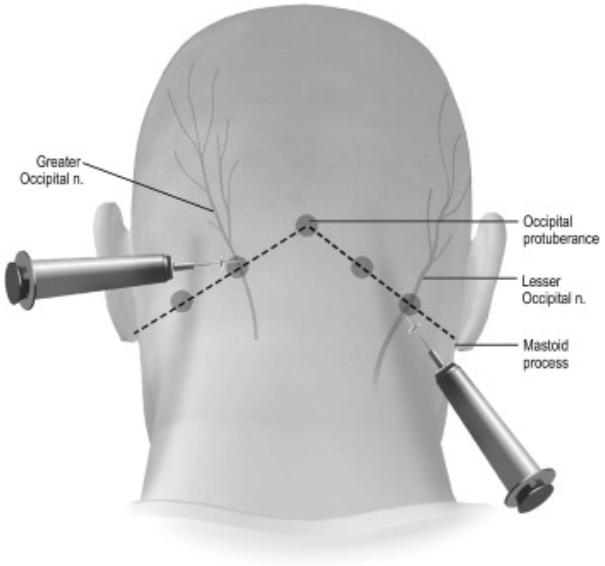
- Sleep hygiene
- Melatonin 3-5 mg qhs

Treat for status migrainosis

- Medical day hospital
- Emergency department

Nerve blocks for headaches

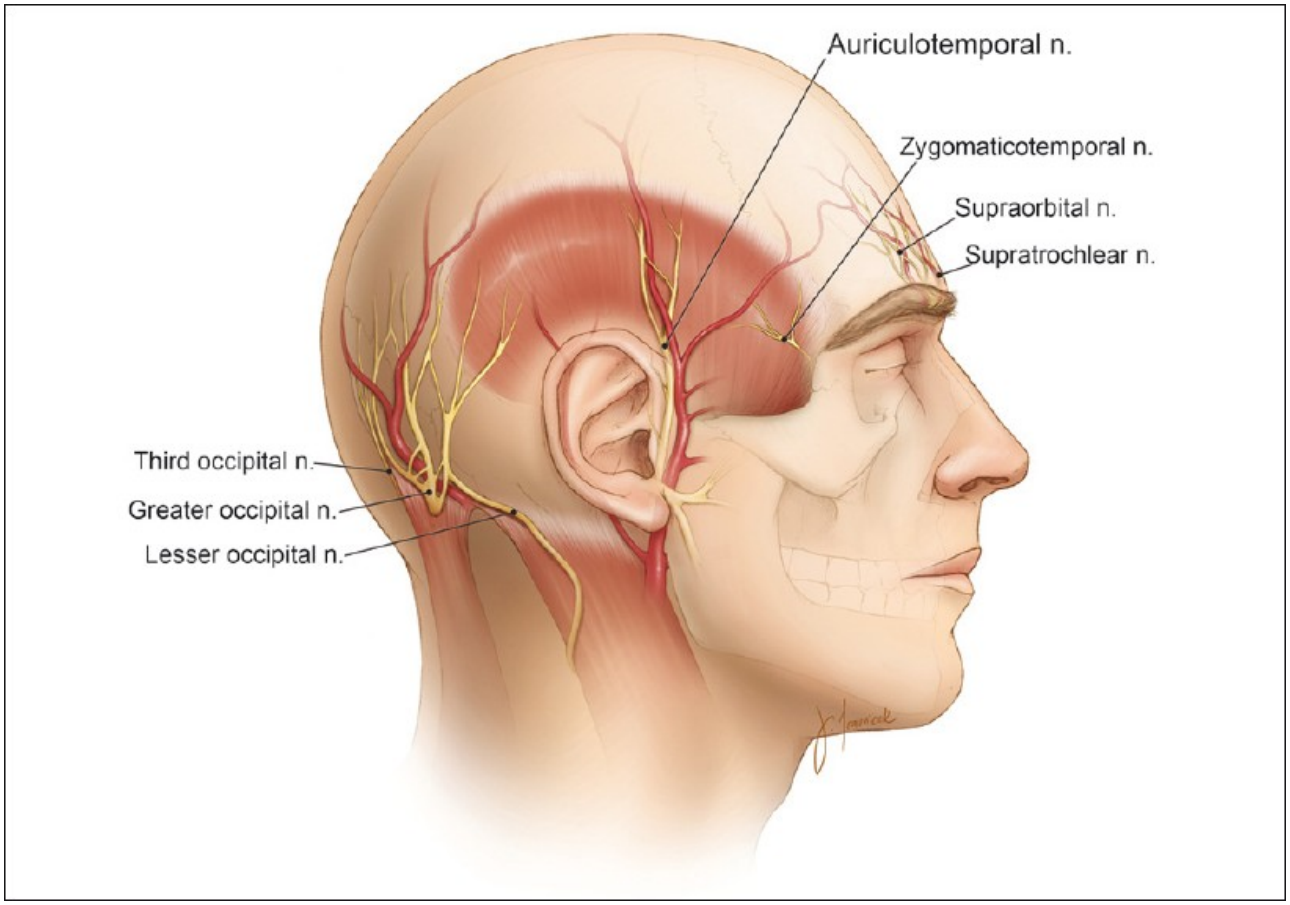
- Consensus recommendations 2013
  - Abortive and preventative
  - Long-lasting effect
  - Various headaches types



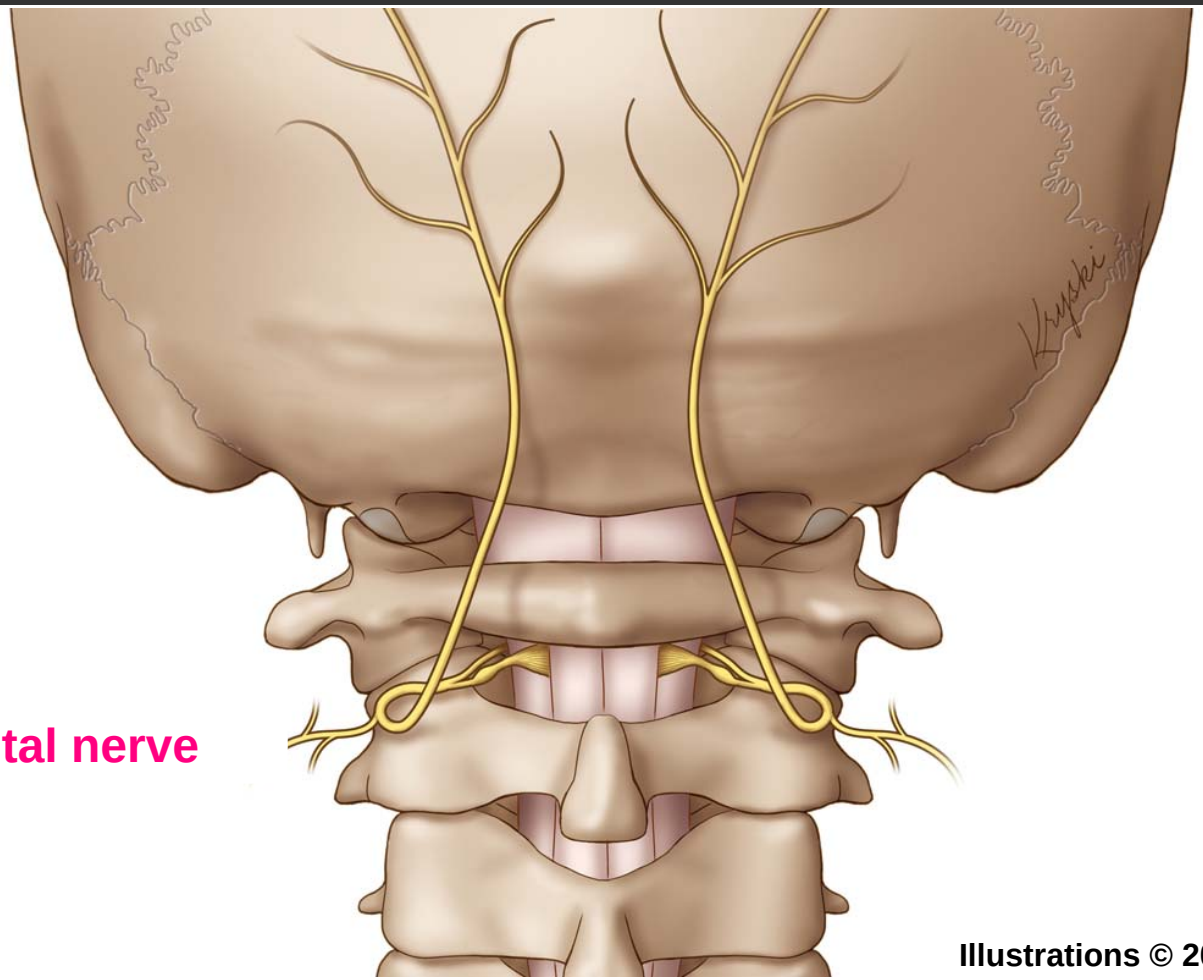
Headache types

- Migraine
- Cluster
- Chronic daily
- Secondary headaches
  - Cervicogenic
  - Post-traumatic

Anatomy 101


Auriculotemporal n.
Zygomaticotemporal n.
Supraorbital n.
Supratrochlear n.
Third occipital n.
Greater occipital n.
Lesser occipital n.

Anatomy 101



Greater occipital nerve

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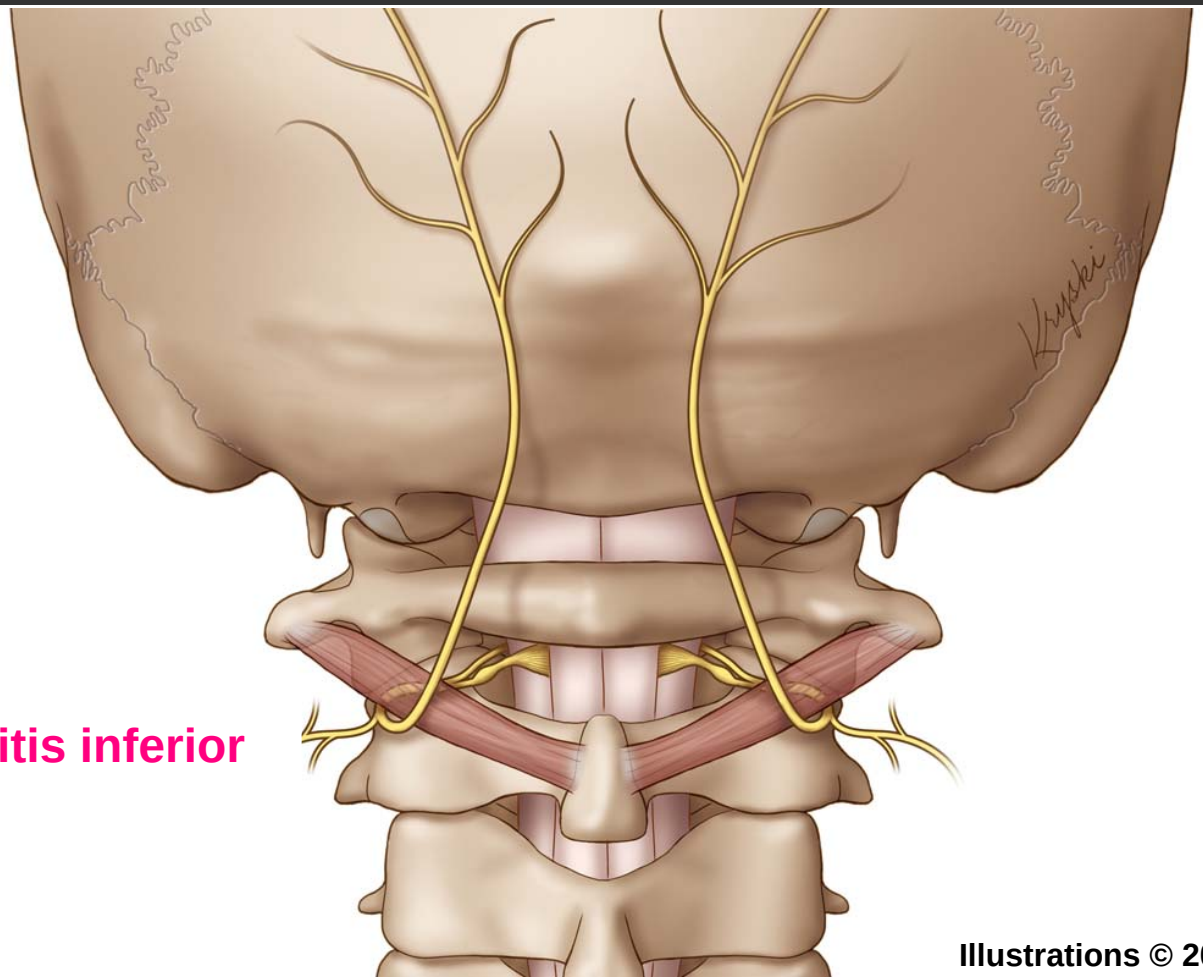
Anatomy 101



Obliquus capitis inferior muscle

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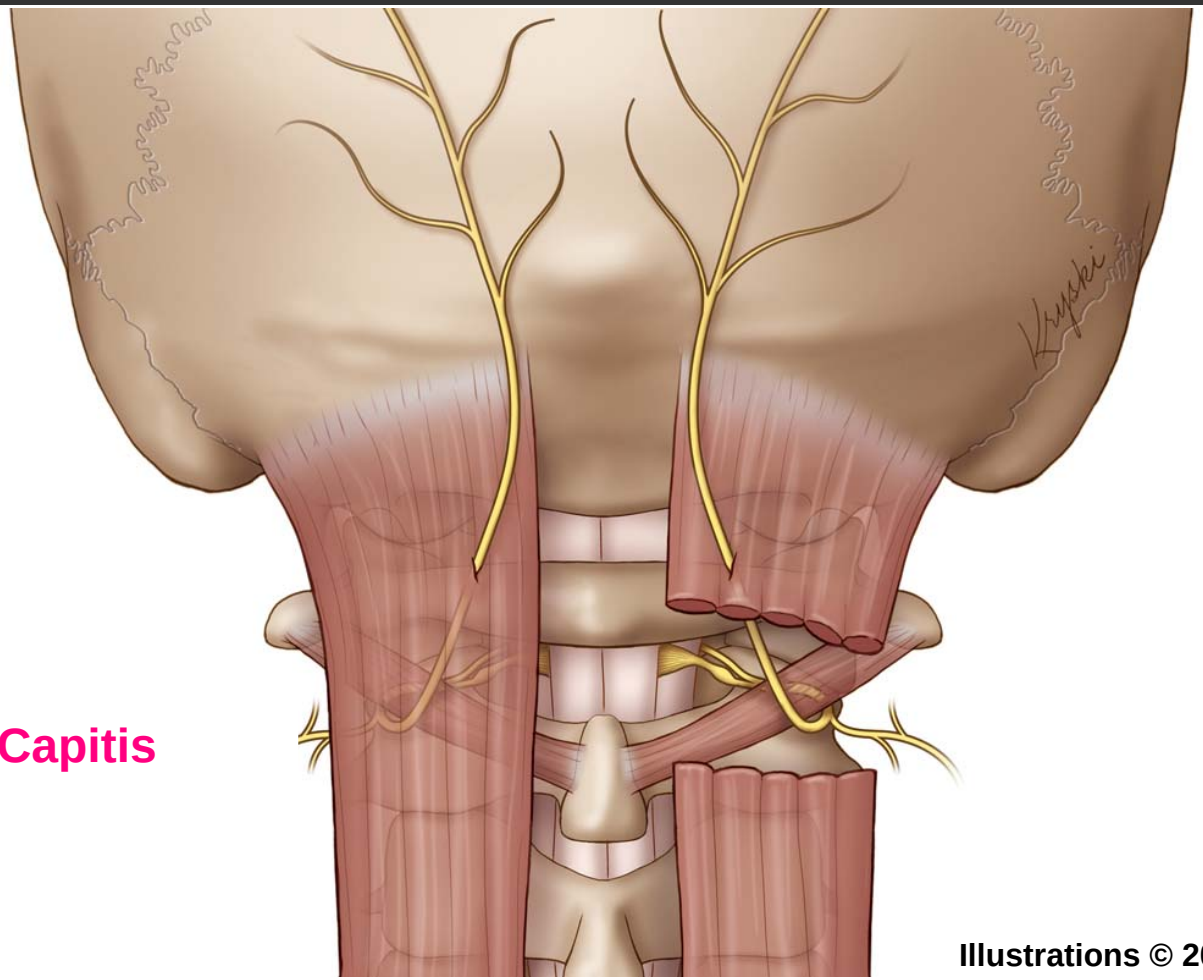
Anatomy 101



Semispinalis Capitis Muscle

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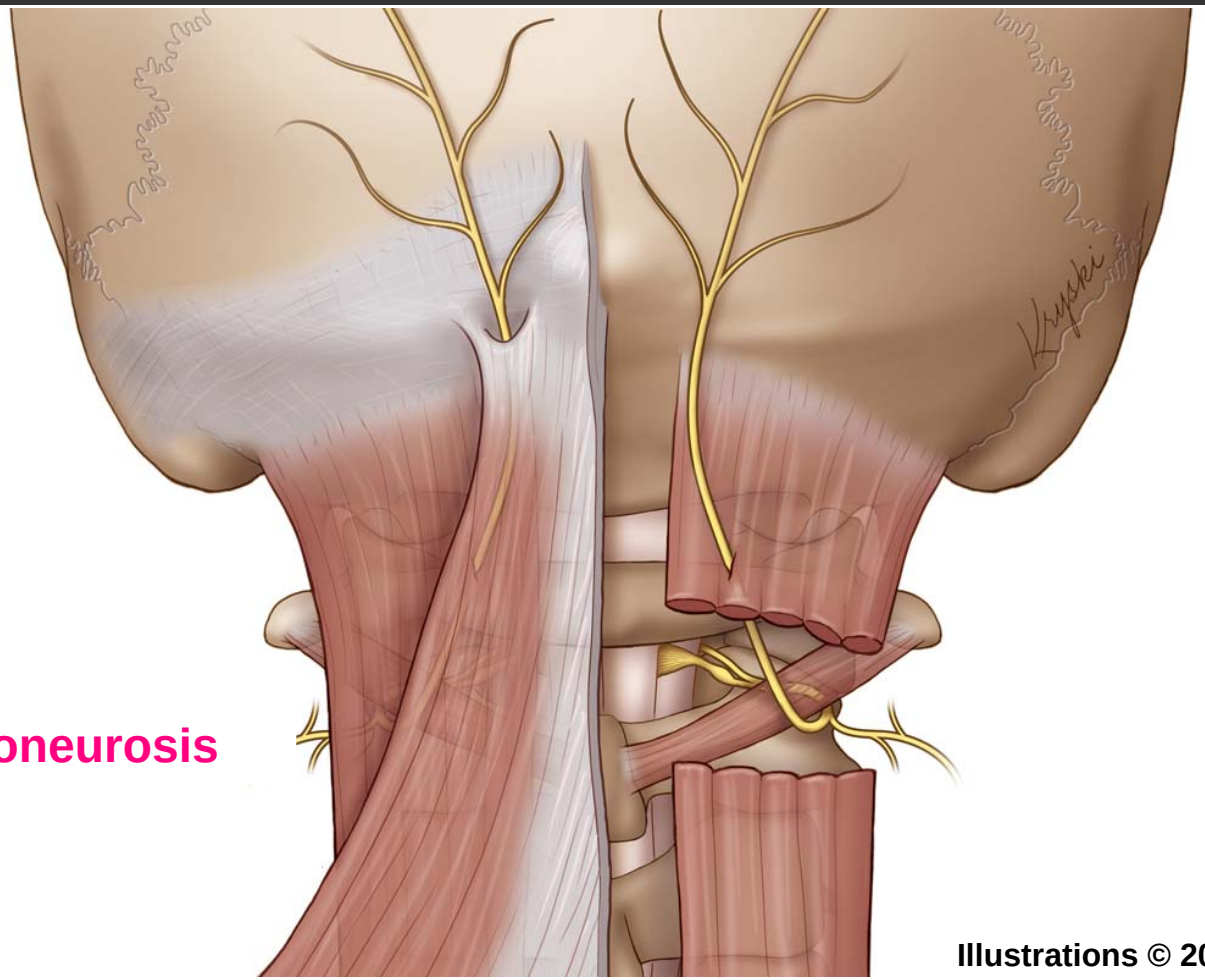

Trapezius Aponeurosis

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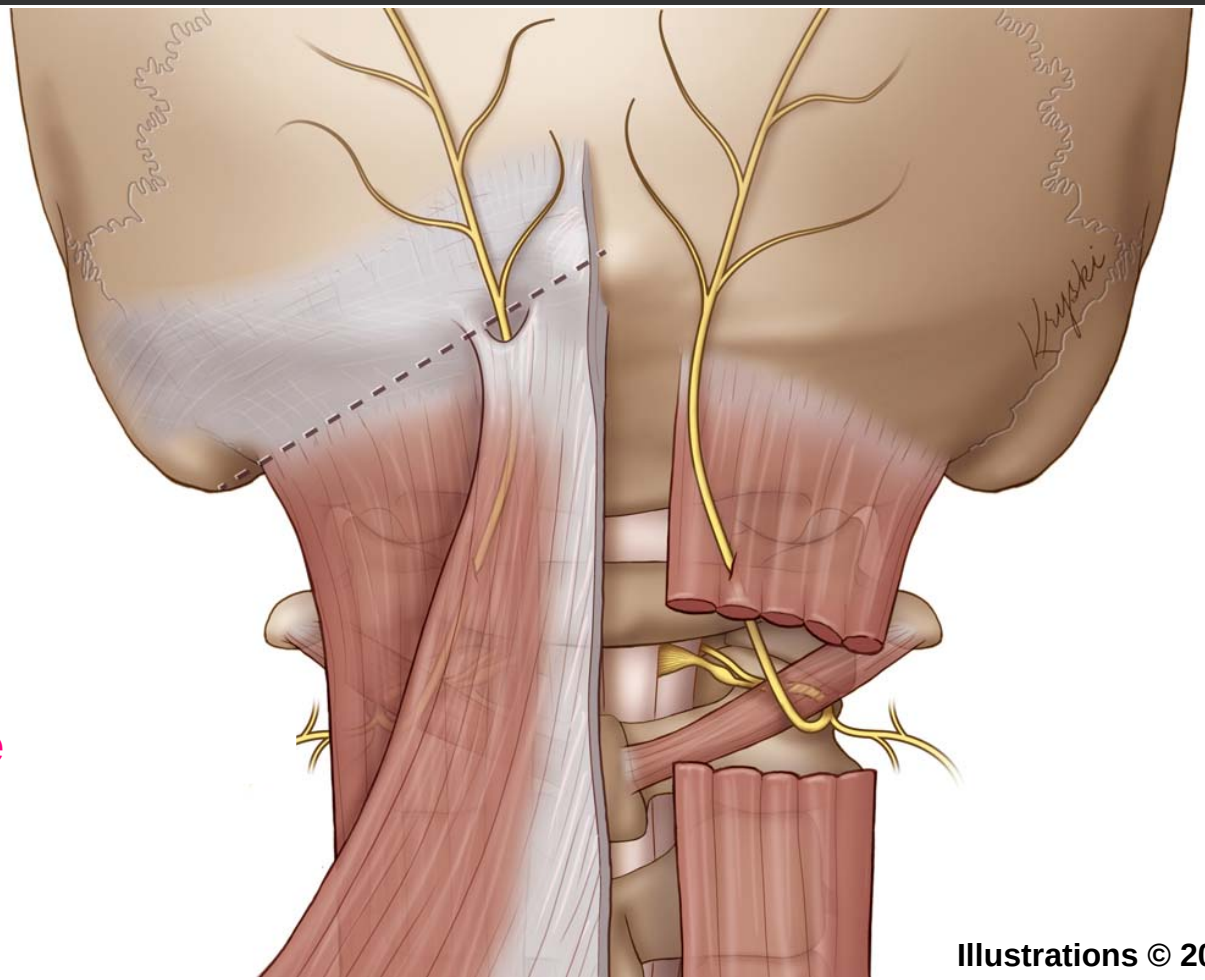
Anatomy 101



~ 1/5 distance

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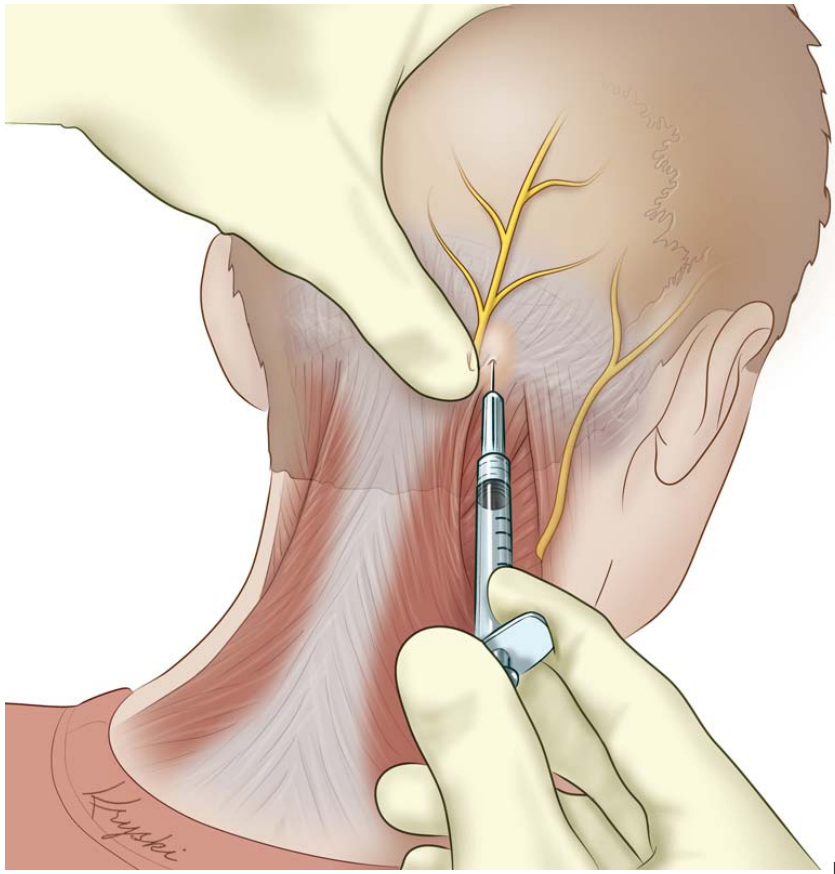
Technique



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Nerve blocks and MTBI

Tobin et al. (2012)

- Adults (n=10)
- 86% reduction in headache intensity

Hecht (2004)

- First detailed series in mTBI (n=10)
- Adults > 18 years of age (mean 37)

Hecht (2004)

- Good response
  - Resolution of pain or relief longer than anesthetic effect of block
  - Requested another block
- Partial response
  - Relief < 24 hours
- No response
  - No effect

MCH Experience: 2012-2013

- Retrospective review of nerve blocks
- Headache and occipital neuralgia
- Lidocaine 2% with epinephrine

  30-Gauge ½ inch needle,
  cc/site, then ice to site(s)

Demographics (n=30 injuries, 28 patients)

Mean Age	14.6 years (10-17)
Female	80%
FH Migraine	76.7%
Past MTBIs	56.7%
Sport-related MTBI	76.7%
Neuroimaging	46.7%
Mean PCS	45.2

Characteristics of nerve blocks

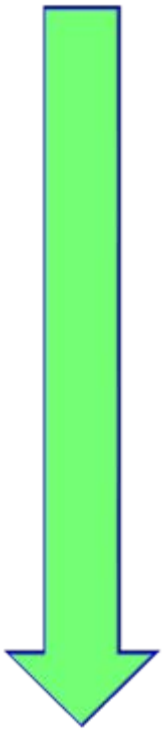
- Mean days from injury to 1st block — 70
- Single nerve blocks — 47%
- Mean No nerve blocks (range) — 2 (1-6)
- Peripheral nerves of the scalp blocked
  - GON — 27%
  - GON+SO — 60%
  - GON+LON±SO — 14%

Effects of nerve blocks

- Mean pre-headache intensity **5.6**
- Mean post-headache intensity **0.4**

Mean percent reduction

93%



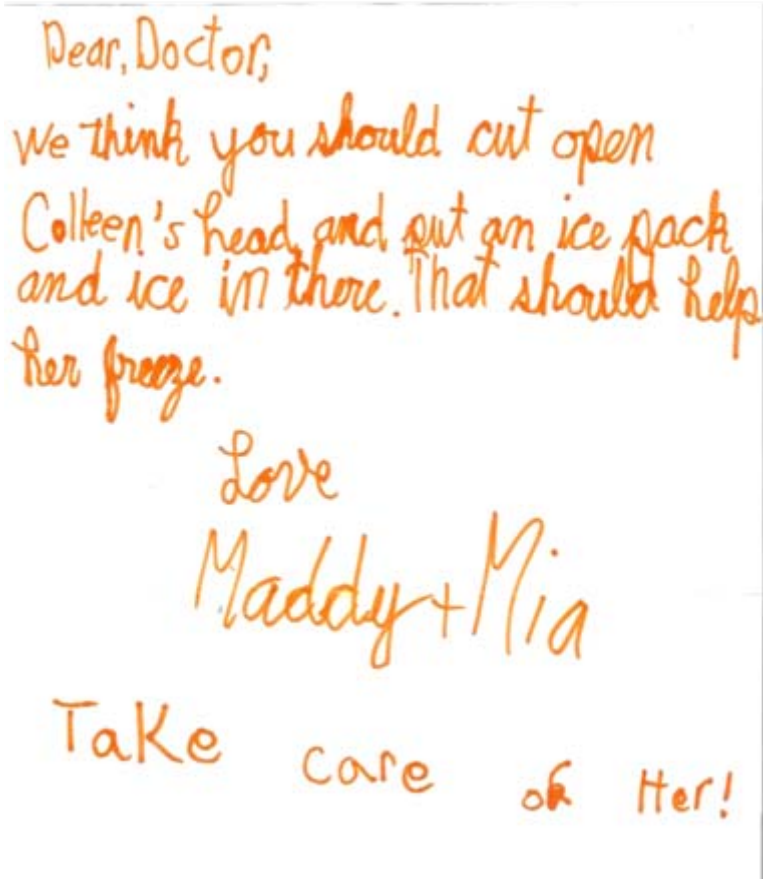
Immediate headache response

- Completely resolved — **71%**
  - Headache 0/10
- Relieved — **24%**
  - Headache 1-2/10
- Poor — **5%**
  - Headache ≥3/10

Therapeutic effect of nerve block

	MCH
Good	93%
▪ Relief ≥24 hours	
▪ Requested another block	
Partial	7%
▪ Relief < 24 hours	
None	0%

Patient Perspective



Dear, Doctor,
We think you should cut open Colleen's head and put an ice pack and ice in there. That should help her freeze.

Love
Maddy + Mia

Take care of Her!

Posted with Colleen's consent

Patient perspective

- “I would like to have another block (the maxeran doesn't help). When do you think it would be possible?”
- “Suite au traitements … le bloc a eu un effet positif sur ses mots de tete. Il a réussis à faire 3 périodes en classe…”
- “<A> has been headache free since the procedure on Friday evening. We are all very happy.”

Satisfaction survey (n=22/28)

- Relieved headache immediately 83%
- Response in the following days/weeks
  - Improved 83%
  - Resolved 61%
  - Cured 26%
- Improved quality of life 74%
- Would recommend to friend 91%

Satisfaction Survey (n=22/28)

- Which treatment would you prefer?
  - Metoclopramide
  - Nerve block
  - Both
  - Neither

Satisfaction survey (n=22/28)

Would recommend to friend:	
Metoclopramide	35%
Nerve block	88%
Would prefer for themselves:	
Metoclopramide	6%
Nerve block	76%
Both	6%
Neither	12%

Metoclopramide versus Nerve Block

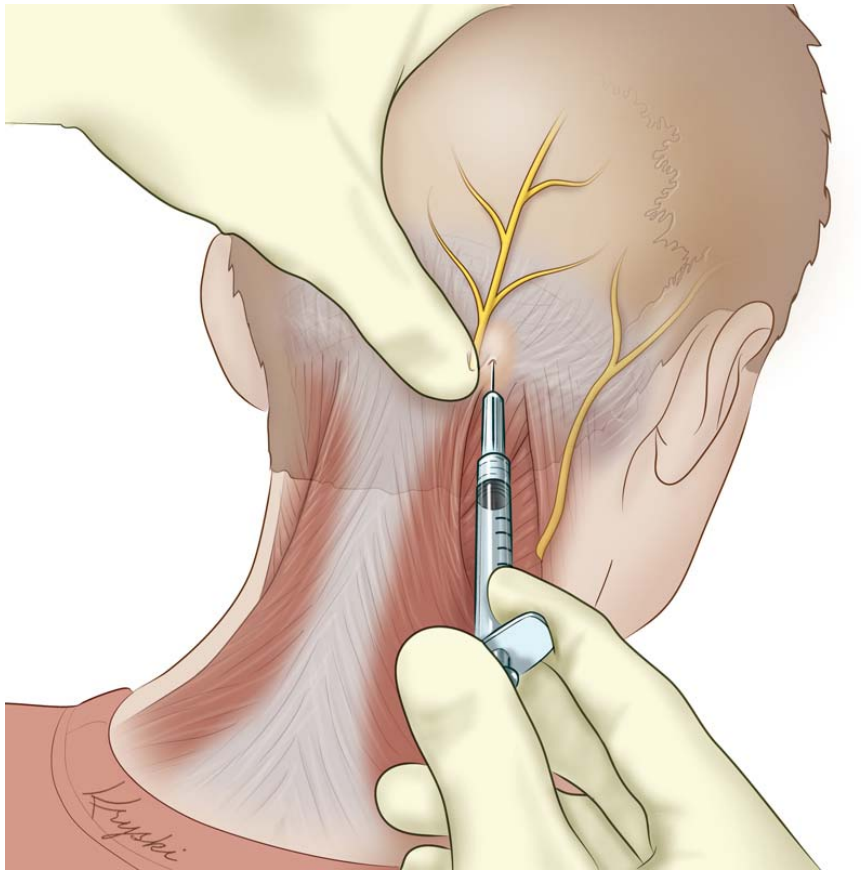
	Metoclopramide	Nerve block
Percent reduction in headache intensity	**74%**	**93%**
Proportion completely resolved headache	**28%**	**71%**

Laughing versus drowsy

Nerve Block

Maxeran

Consider…



Take home

Take home

- Concussion have morbidity … suffering x 1-2 months
- Rest is hallmark of therapy
- Graded return to school/play
- Inter-professional approach for complicated/persistent

Future directions

- What treatment(s) are most effective for post-concussion headaches?
  - RCT
- Can we predict who will be slow to recover?
  - Roger Zemeck, Isabelle Gagnon and Sasha Dubrovsky

Questions/comments

- sasha.dubrovsky@mcgill.ca
- www.thechildren.com/trauma