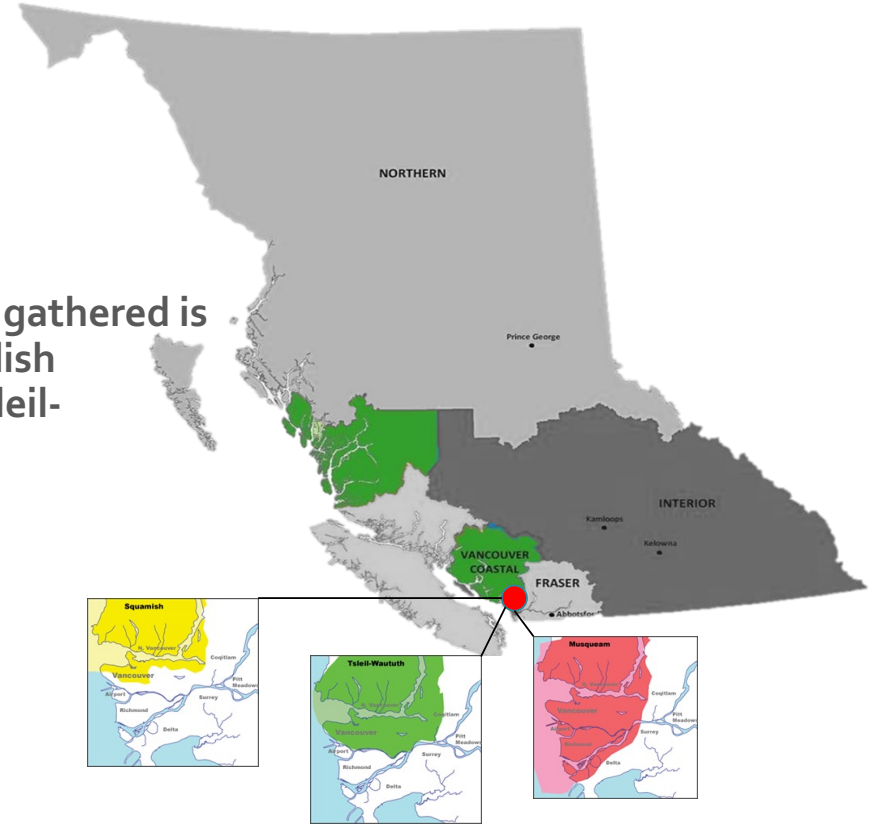
Assessment and Management of Concussions with Persistent Symptoms

Giorgia Tropini, MD, MSc, CCFP

VCH Family and Community Practice Rounds - Nov 22, 2023

I wish to acknowledge that the land on which we are gathered is the traditional and unceded territory of the Coast Salish Peoples, including the Musqueam, Squamish, and Tsleil-Waututh Nations.



Introductions and Disclosures

- ***Family medicine and concussion medicine physician***
  - *UBC Student Health Service*
  - *Area of interest:* ***Concussions with persistent symptoms***
- ***Clinical Instructor, UBC***
- MD (University of Toronto), MSc (UBC), CCFP (UBC- St Paul's)
- **R3 in Concussion Management** (UBC, GF Strong Rehabilitation Centre)

- *No conflicts or disclosures.*

Objectives

1. Review recent **updates in concussion medicine**
2. Review **risk factors for prolonged recovery** from a concussion
3. Review **pharmacological and non-pharmacological strategies** for the management of *adult* concussions with persistent symptoms

Concussion Updates 2022-2023

Amsterdam 2022 Consensus Statement on Concussion in Sport

6th International Conference on Concussion in Sport

- Updated **definition** of concussion
- Updated Sport Concussion Assessment Tool (**SCAT6** and **Child SCAT6**)
  - Best within **<72 hrs and up to 1 week**
- New Sport Concussion Office Assessment Tool (**SCOAT6** and **Child SCOAT6**)
  - Companion to SCAT6, **for >72hrs to <4 wks**
- **Prevention** recommendations
  - Mouthguard use in hockey, rule changes to reduce collisions, neuromuscular training in warm-up, protocols for removal from play/return to play
- Early exercise as treatment
- Referral of patients with **persistent symptoms (>4 wks)**
  - Multidisciplinary treatment

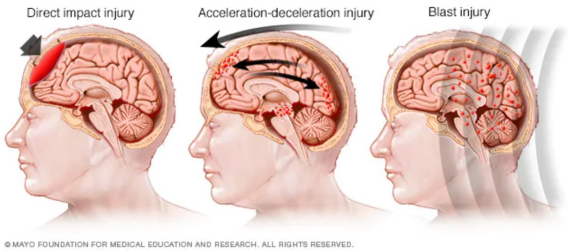
Patricios JS, Schneider KJ, Dvorak J, et al. Consensus statement on concussion in sport: the 6th International Conference on Concussion in Sport–Amsterdam, October 2022. British Journal of Sports Medicine 2023;57:695-711.

A note about exercise & rest

(Amsterdam Consensus Statement, Concussion in Sport 2022)

- **Rest is NOT the best medicine**
  - Prolonged rest associated with delayed recovery
  - **Relative rest x 24-48H**
    - ADLs allowed
    - Reduced screen time
    - Light physical activity (eg walking) ok
- Thereafter, **gradually increase cognitive and physical activity as tolerated**
  - Avoid activities with high risk of re-injury in first 7-10 days
- **Exercise is beneficial in recovery**
  - **Sub-symptom threshold**
    - Symptom increase of 1-2 pts on 0-10 scale
    - Brief exacerbation (<1 hr)
  - **STOP and rest if >2 pts, > 1hr**

- Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org
- Leddy JJ et al. Rest and exercise early after sport-related concussion: a systematic review and meta-analysis. Br J Sports Med. 2023 Jun;57(12):762-770
- Patricios JS, Schneider KJ, Dvorak J, et al. Consensus statement on concussion in sport: the 6th International Conference on Concussion in Sport–Amsterdam, October 2022. British Journal of Sports Medicine 2023;57:695-711.



Updated Definition of Concussion

(Amsterdam Consensus Statement, Concussion in Sport 2022)

- A sports-related concussion is a **traumatic brain injury** caused by a direct blow to the **head, neck or body**, resulting in an **impulsive force being transmitted to the brain**
- This initiates a **neurotransmitter and metabolic cascade** affecting the brain
  - Axonal injury, blood flow changes and inflammation
- Signs and symptoms **can present immediately or evolve over minutes or hours**
  - Commonly resolve within days, but may be prolonged .

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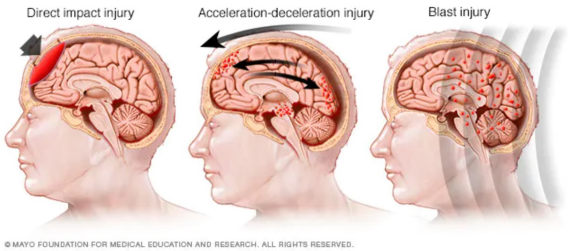

Updated Definition of Concussion

(Amsterdam Consensus Statement, Concussion in Sport 2022)

- **No abnormality is seen on standard structural neuroimaging** (CT/MRI)
  - In research setting, abnormalities may be present (functional, blood flow or metabolic imaging)
- Concussion results in a range of **clinical signs and symptoms that may or may not involve LOC.**
- The clinical signs and symptoms **cannot be explained solely by**
  - **drug, alcohol, or medication** use
  - **other injuries** (such as cervical injuries, peripheral vestibular dysfunction, etc)
  - other **comorbidities** (eg, psychological factors or coexisting medical conditions).

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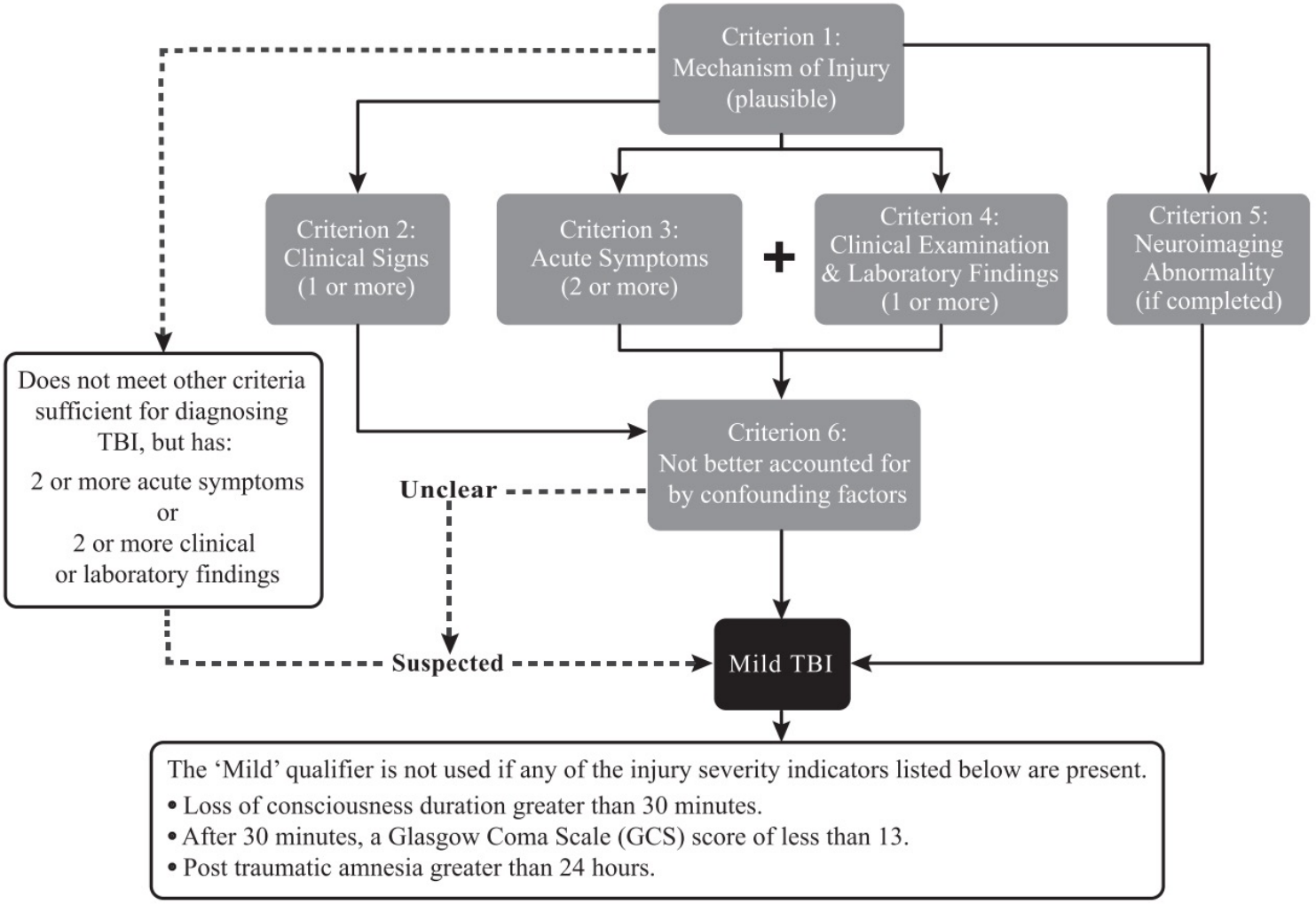
Concussion Diagnosis

ACRM 2023



Silverberg ND et al. The American Congress of Rehabilitation Medicine Diagnostic Criteria for Mild Traumatic Brain Injury. Arch Phys Med Rehabil. 2023 Aug;104(8):1343-1355

Concussion Diagnosis

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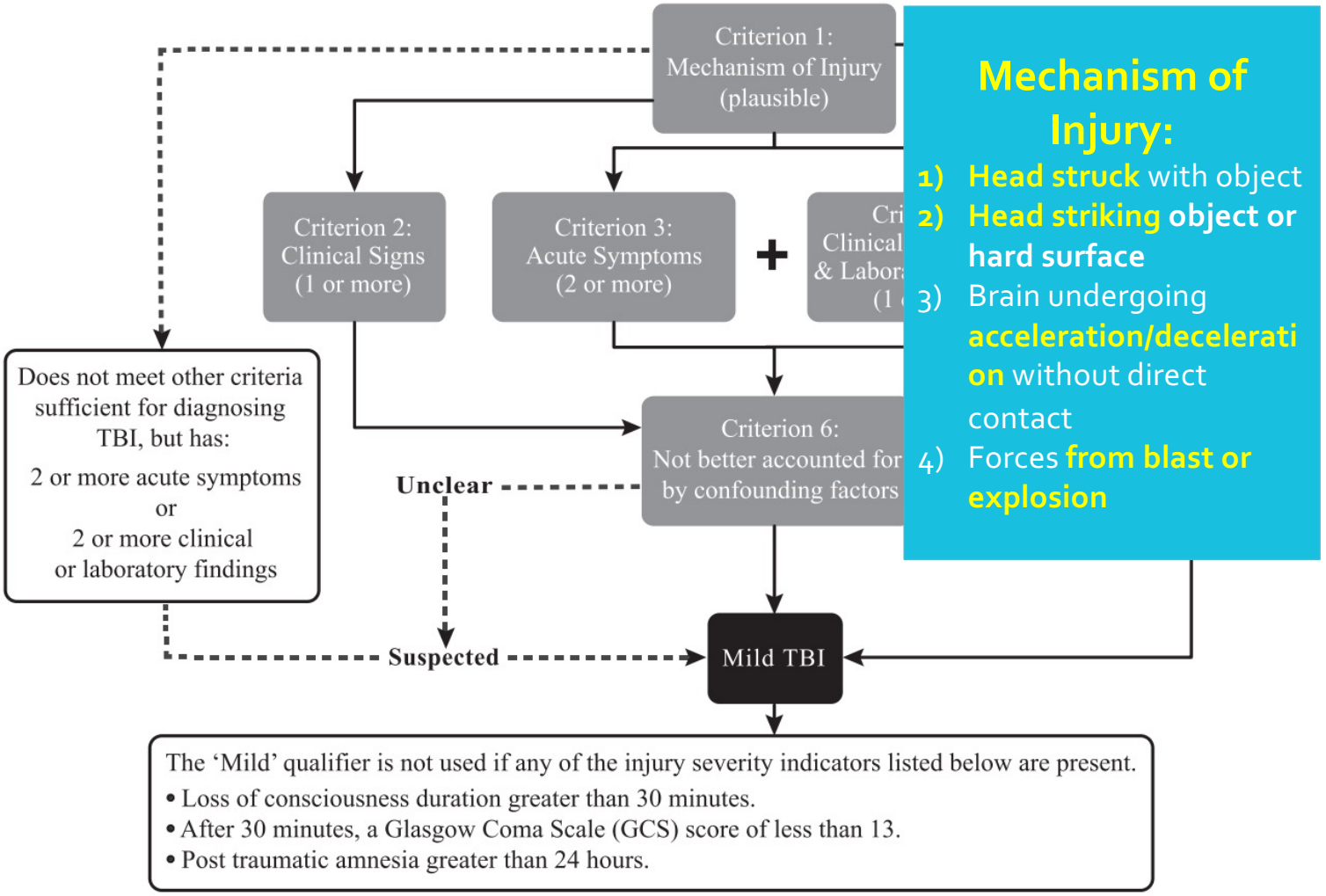

Mechanism of Injury:

1) **Head struck** with object
2) **Head striking object or hard surface**
3) Brain undergoing **acceleration/deceleration** without direct contact
4) Forces **from blast or explosion**

Concussion Diagnosis

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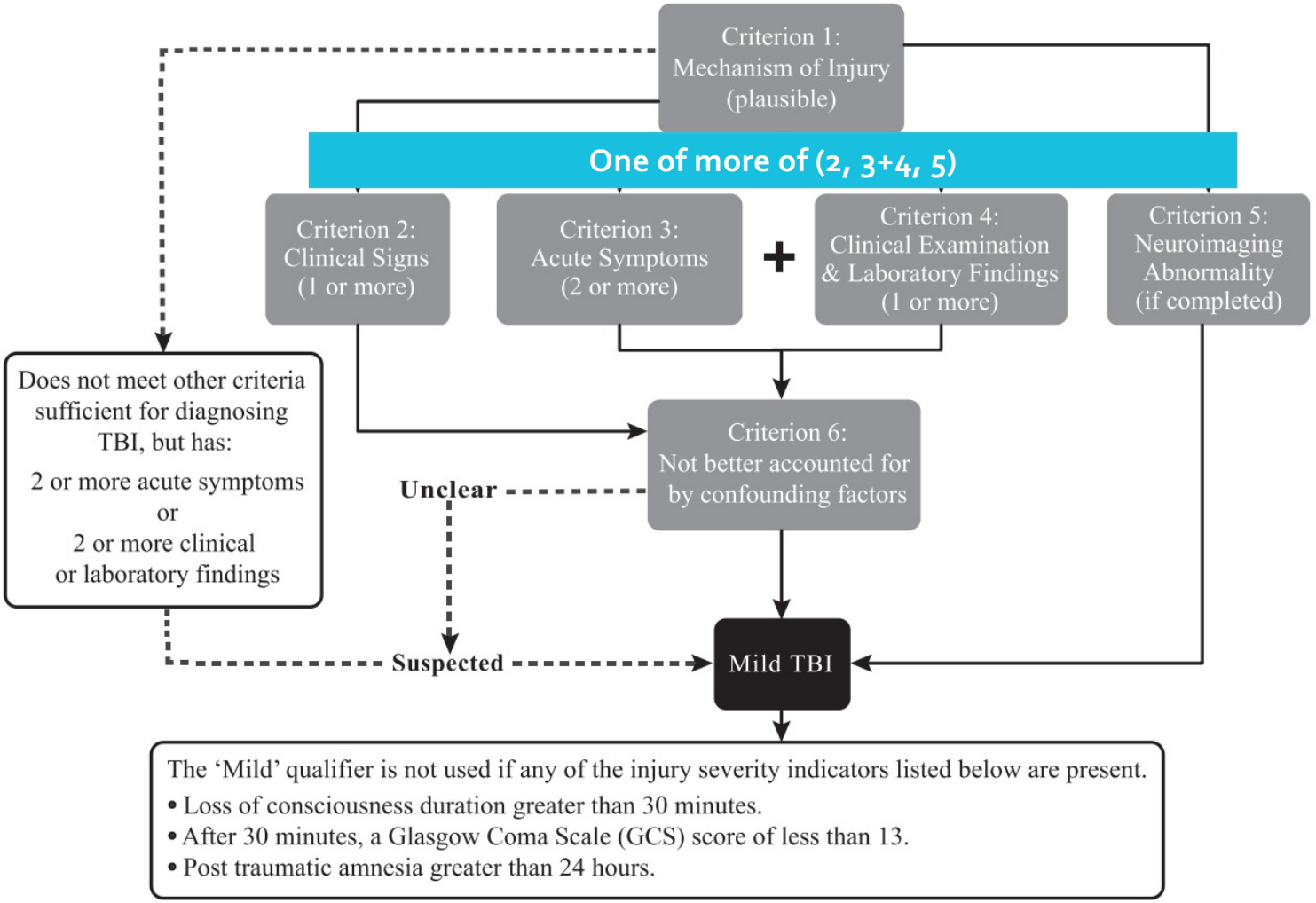

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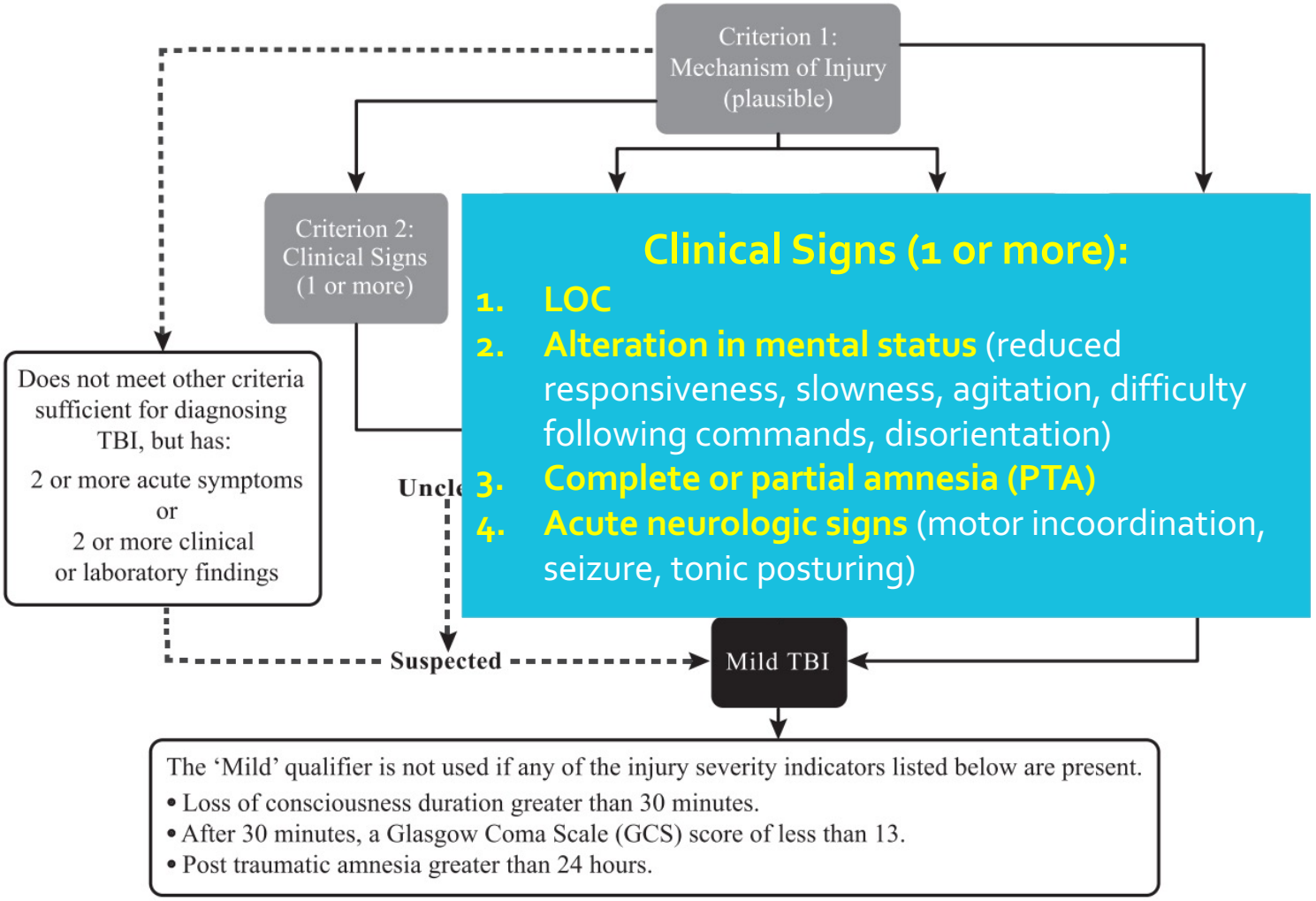

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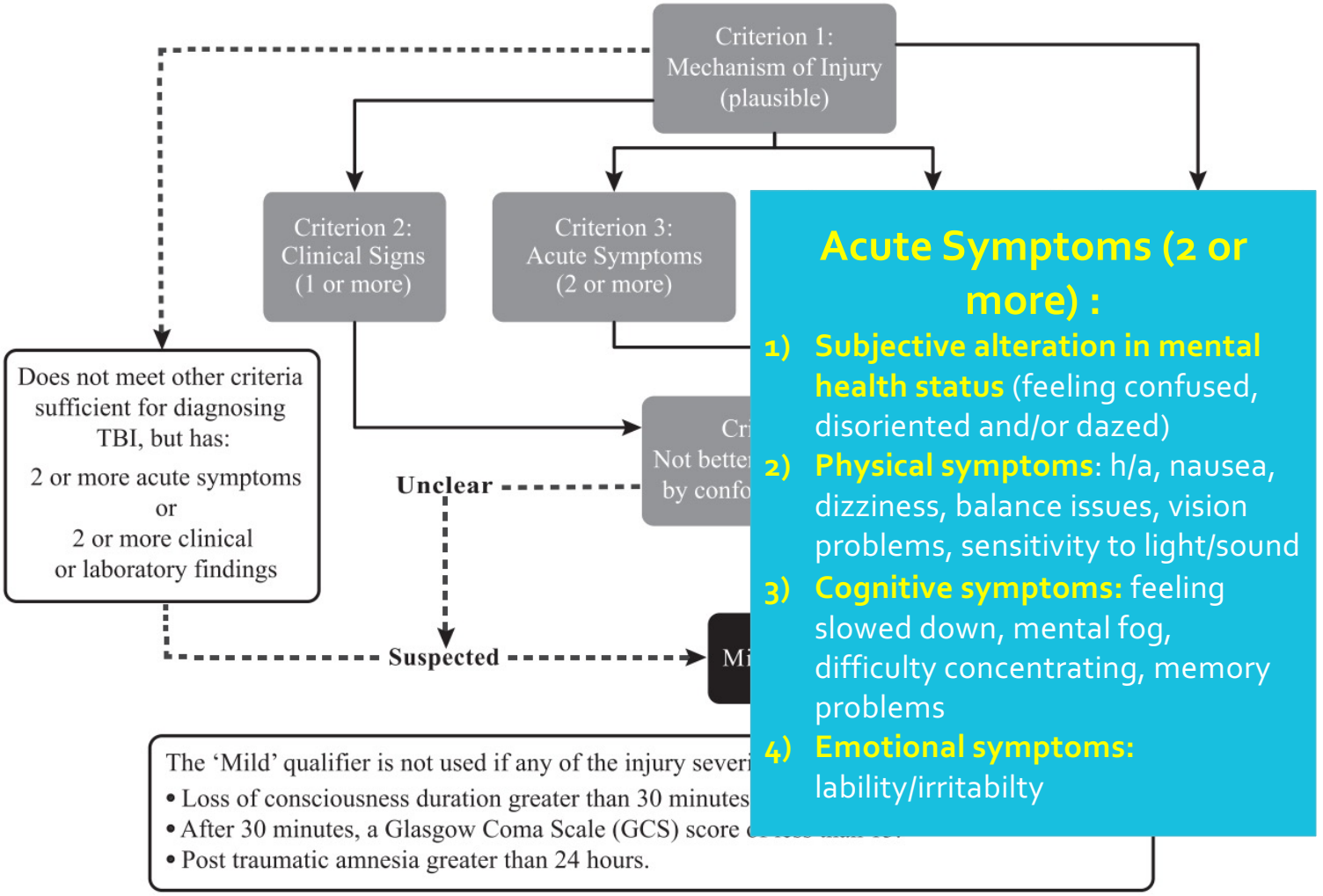

Acute Symptoms (2 or more) :

1) **Subjective alteration in mental health status** (feeling confused, disoriented and/or dazed)
2) **Physical symptoms**: h/a, nausea, dizziness, balance issues, vision problems, sensitivity to light/sound
3) **Cognitive symptoms:** feeling slowed down, mental fog, difficulty concentrating, memory problems
4) **Emotional symptoms:** lability/irritabilty

Concussion Diagnosis

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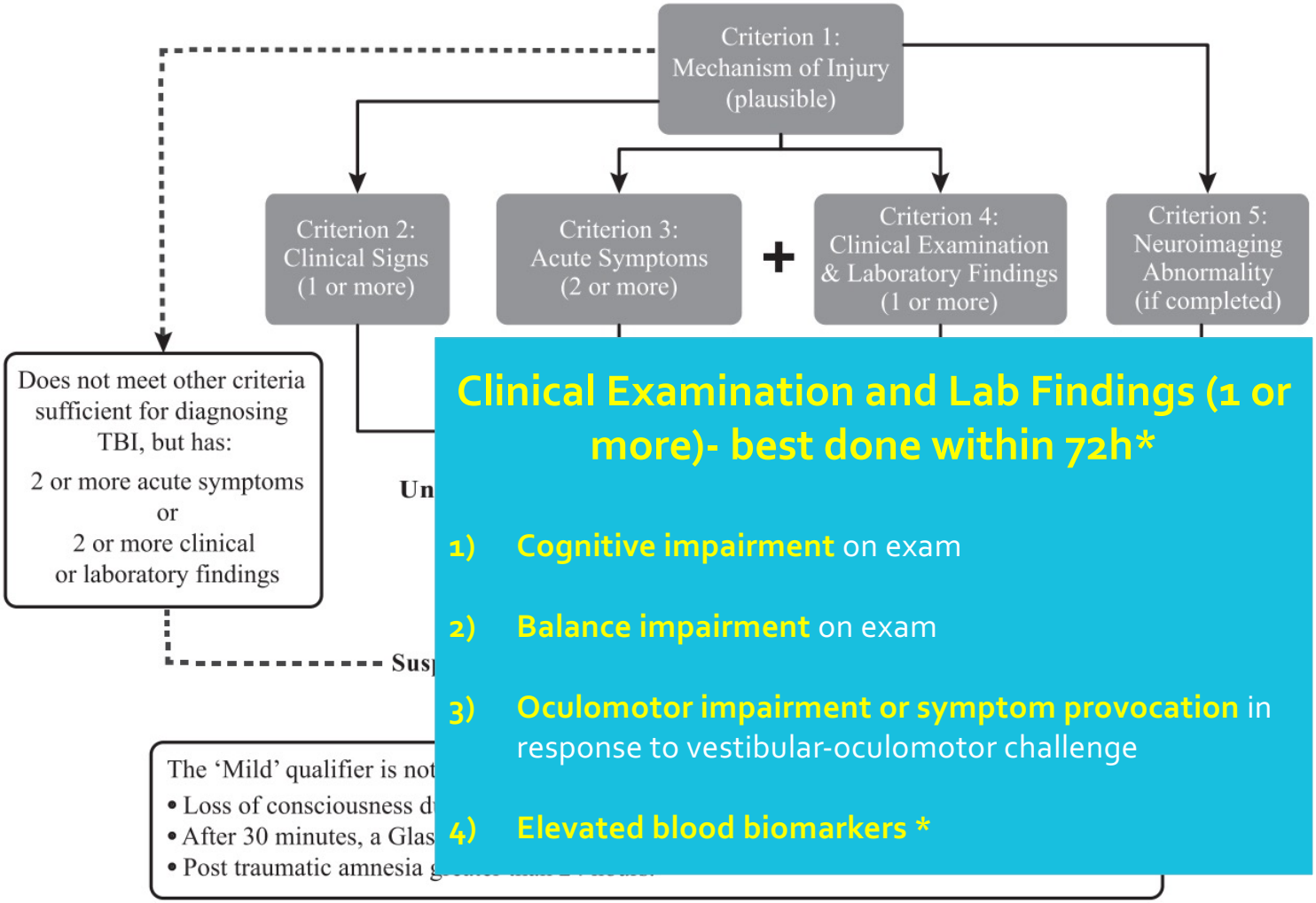

Clinical Examination and Lab Findings (1 or more)- best done within 72h*

1) **Cognitive impairment** on exam
2) **Balance impairment** on exam
3) **Oculomotor impairment or symptom provocation** in response to vestibular-oculomotor challenge
4) **Elevated blood biomarkers ***

Concussion Diagnosis

ACRM 2023

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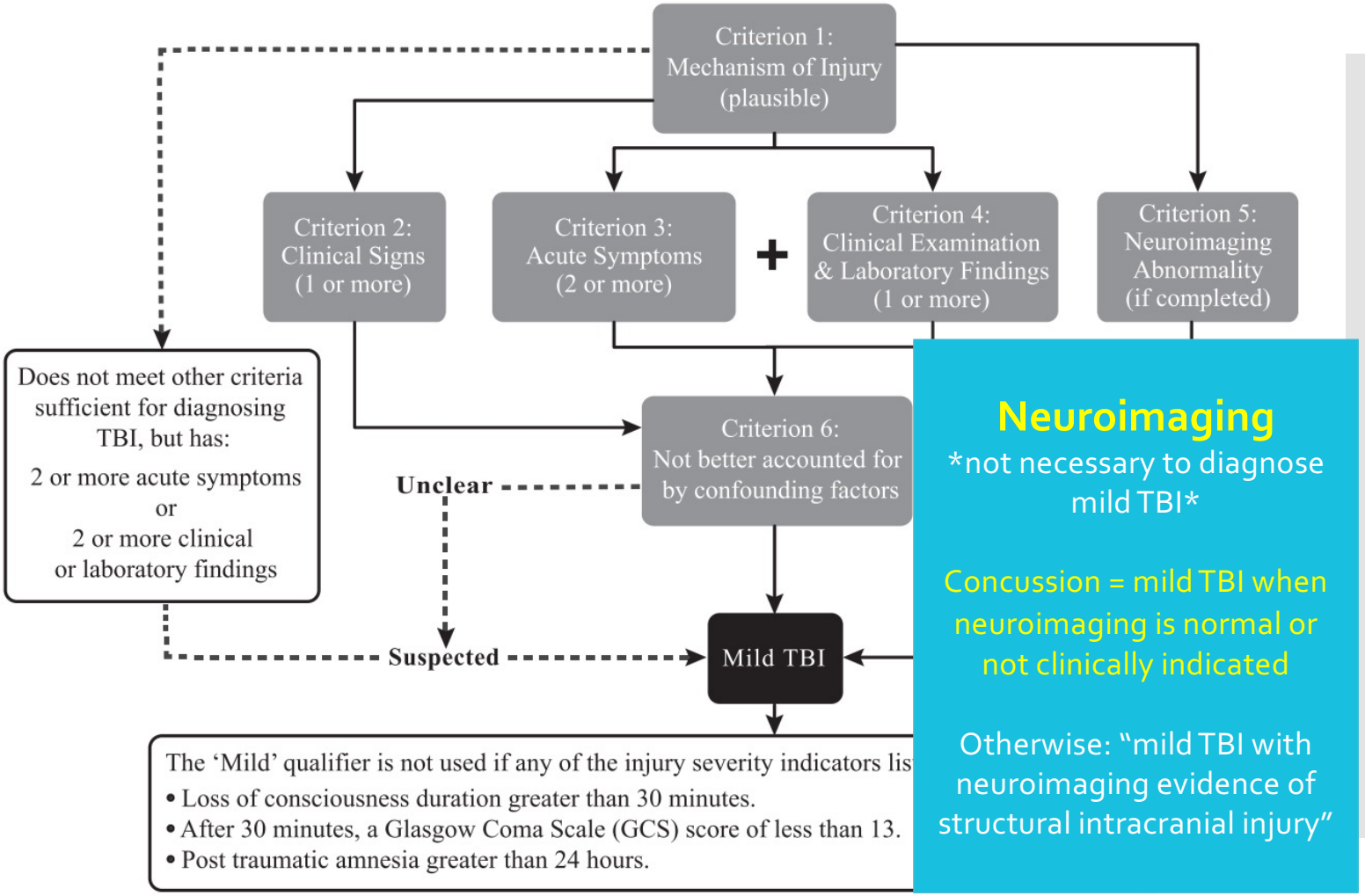

Neuroimaging

not necessary to diagnose mild TBI

Concussion = mild TBI when neuroimaging is normal or not clinically indicated

Otherwise: "mild TBI with neuroimaging evidence of structural intracranial injury"

Concussion Diagnosis

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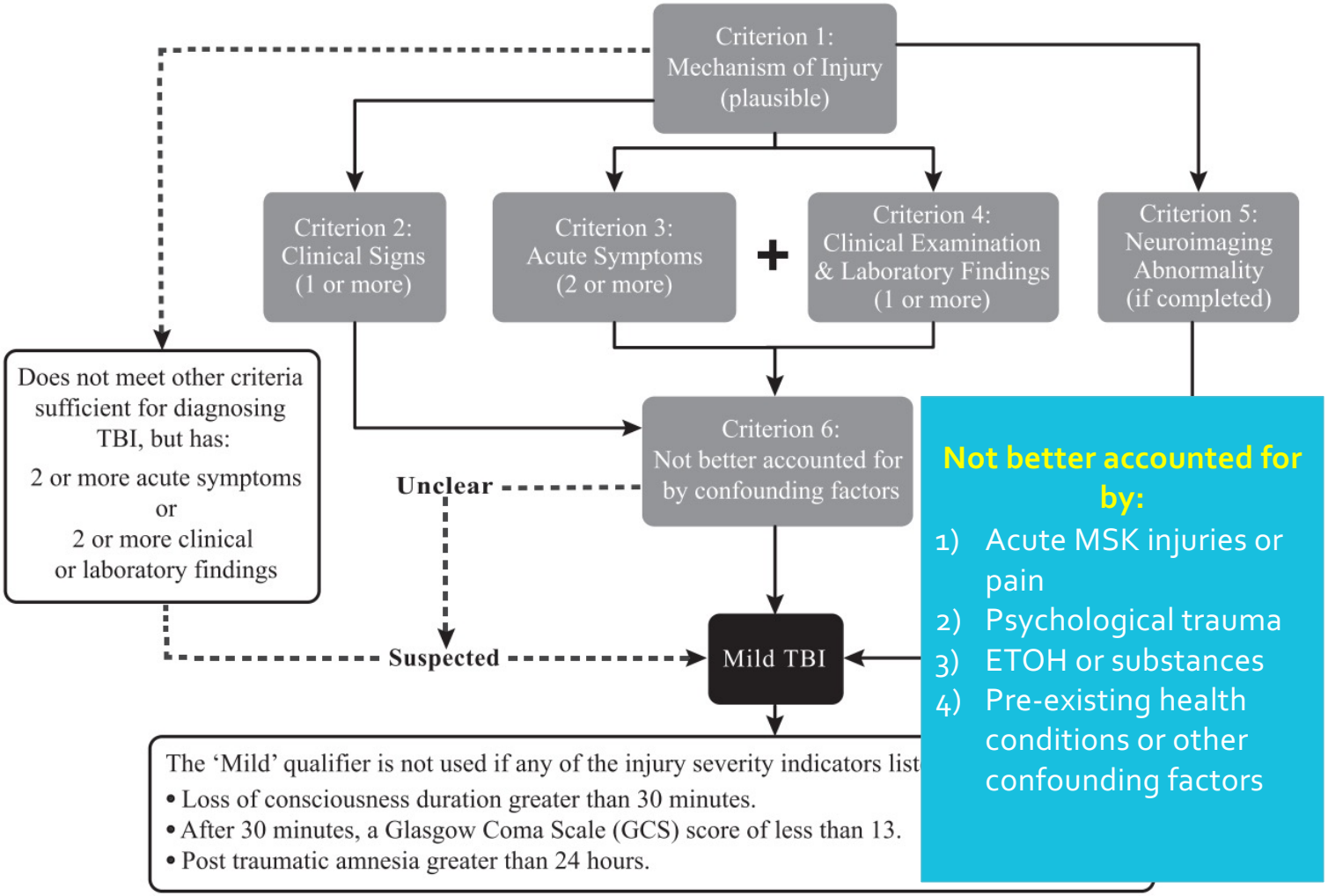

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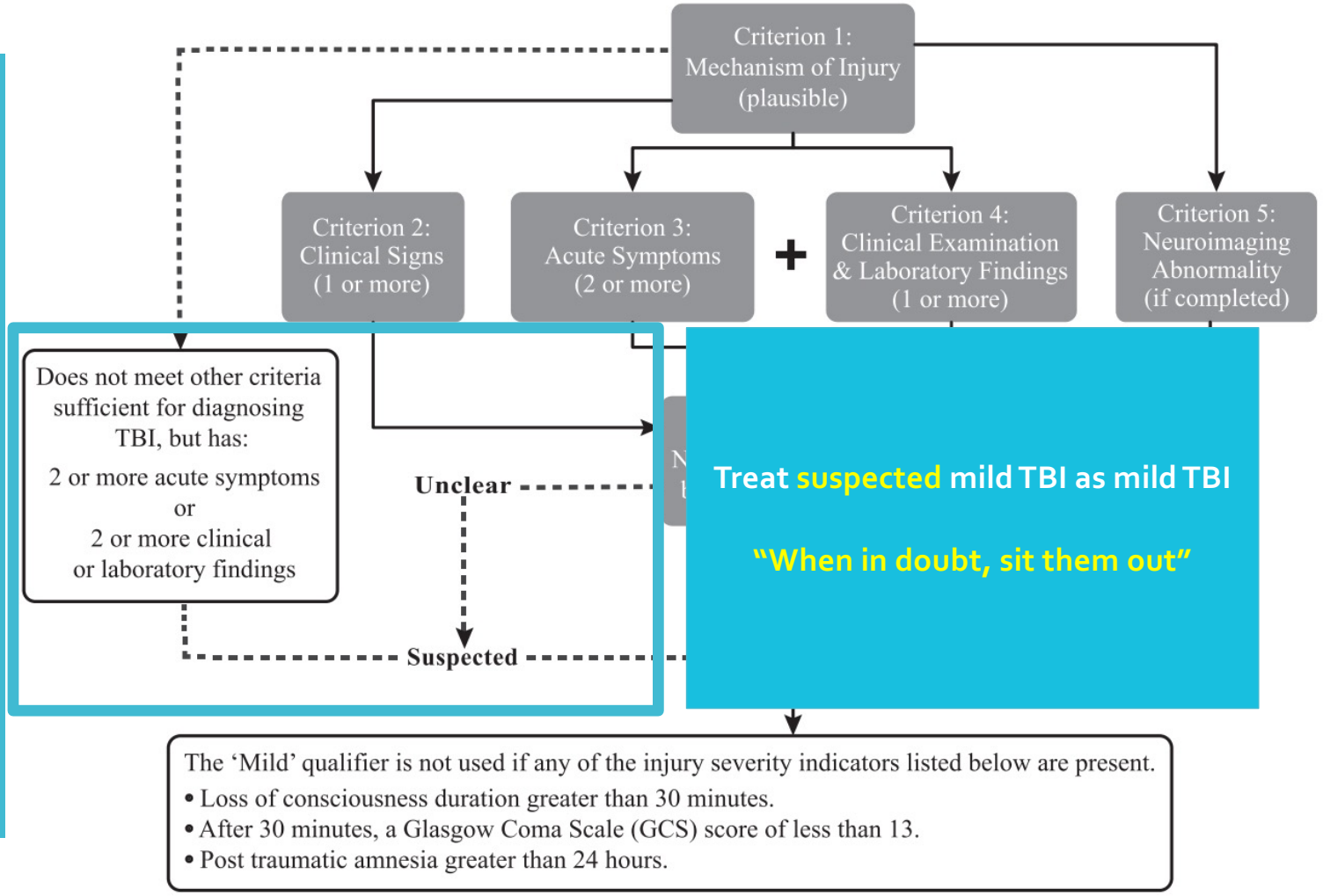

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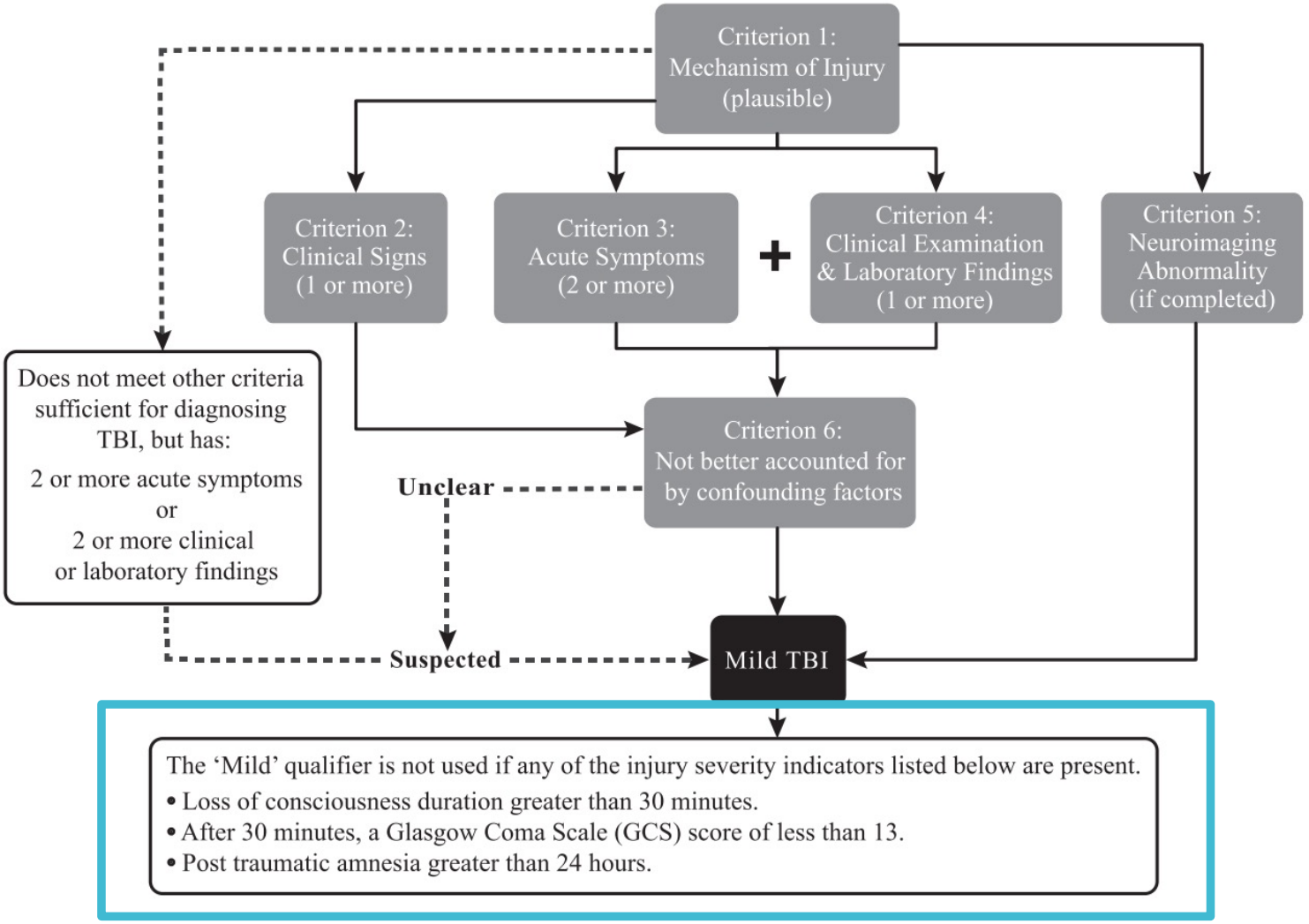

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Concussions with persistent symptoms

Prognosis

- Concussion is a transient condition with a good prognosis
  - Majority will be symptom-free at 3 months
- However, ~15-20% will have a complicated recovery
  - 6 months
    - 70-75% will be symptom free
  - 1 year
    - 10% will have 1 persisting symptom
    - 5% will have 4+ persisting symptoms

-Iverson, G., Zasler, N., and Lange, R.T. (2006). Post-Concussive Disorder. Brain Injury Medicine: Principles and Practice. New York: Demos - Publications.

-Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Why the wide range?

Medical Factors: Pre-existing/ concurrent medical conditions or post-injury symptoms that are associated with poor outcomes post mTBI	• History of previous traumatic brain injury • History of previous physical limitations • History of previous neurological or psychiatric problems • Skull fracture • Early onset of pain and in particular headache within 24 hours after injury • Confounding effects of other health-related issues, e.g., pain medications, disabling effects of associated injuries, emotional distress • Anxiety • High number of symptoms reported early after injury i.e., high score on the Rivermead or Post Concussion Symptom Questionnaire - Vestibular/vestibular-ocular abnormalities - Pre-injury sleep disturbance or post-injury changes - Reduced balance or dizziness - Nausea after injury - Memory problems after injury - Post-traumatic amnesia (PTA)

"Yellow Flags"

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Why the wide range?

Contextual Factors: **Personal, psychosocial, or environmental factors that may negatively influence recovery post mTBI**	• Injury sustained in a motor vehicle accident • Potential influence of secondary gain issues related to litigation and compensation • Not returning to work or significant delays in returning to work following the injury • Being a student • Presence of life stressors at the time of the injury • Higher levels of symptom reporting is associated with mood symptoms and heightened self-awareness of deficits • Older age • Lack of social supports • Lower education/low social economic status • Female gender • Lower Resiliance • Returning to a contact/ risk of contact sport activity

"Yellow Flags"

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Assessment

Assessment in office

- **History**
  - Mechanism of injury
  - LOC?, PTA?, confusion/disorientation?
  - **Symptoms**

Physical	Behavioural/Emotional	Cognitive
Headache	Drowsiness	Feeling “slowed down”
Nausea	Fatigue/lethargy	Feeling “in a fog” or “dazed”
Vomiting	Irritability	Difficulty concentrating
Blurred or double vision	Depression	Difficulty remembering
Seeing stars or lights	Anxiety	
Balance problems	Sleeping more than usual	
Dizziness	Difficulty falling asleep	
Sensitivity to light or noise		
Tinnitus		
Vertigo		

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Questionnaires

(patient completes before visit)

- **Rivermead Post-Concussion Symptoms Questionnaire**
  - Identification of symptom severity and burden
- **PHQ9**
  - Assessment of depressive symptoms
- **GAD7**
  - Assessment of anxiety
- **Insomnia Severity Index (ISI)**
  - Insomnia severity and functional impact
- **Headache Impact Test (HIT-6)**
  - Headache severity and functional impact

Assessment in office

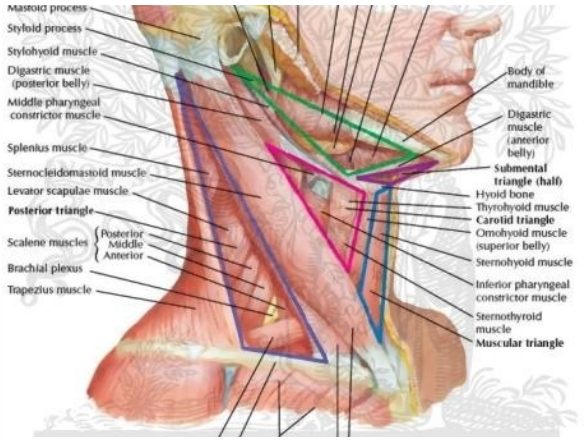
- **History**
  - **Past medical history** and **Yellow flags**
    - **Mental health conditions**
    - **ADHD/Learning disability**
    - **Chronic headaches/migraines**
    - **Prior head injuries**
    - **MVA or litigation**
  - **Functional and social history**
    - Occupation
    - Accommodations?
    - Impact on function
    - Routine*
  - **Medications**
  - **Substances**
    - ETOH, cannabis, street drugs

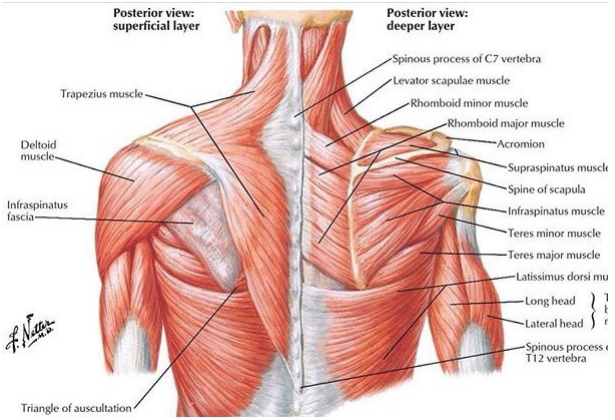
Useful questions

- How much have you recovered? (0-100%)
- What are your expectations for recovery?
  - E.g. "I will recovery slowly" "I don't think I will fully recover"
    - Yellow flags
- Treatments so far
  - Eg Physio, RMT, counselling

Exam

- **Vitals**
  - (Orthostatic vitals if dizzy)
- **Neurological exam**
  - MSE
    - (attention, memory)
  - Gait, balance, Romberg
  - CN II-XII
    - **VOMS***
      - **Smooth pursuit***
      - **Saccades**
      - **Near point convergence***
      - **VOR/VOR suppression**
  - Tone and reflexes
  - Motor assessment
  - Sensory screen
  - Cerebellar exam
  - **(Dix-Hallpike)**
- **Neck exam**
  - ROM
  - Palpation





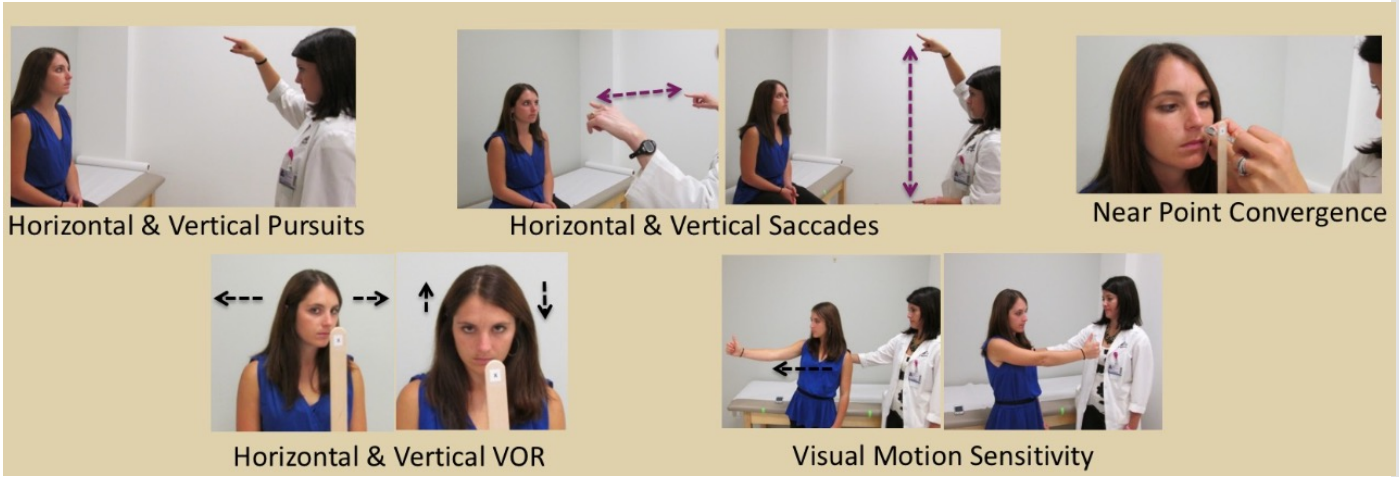
Near Point Convergence

- **Convergence insufficiency** (image splitting at >10 cm / 4 inches from bridge of nose)

Mucha A, Collins MW, Elbin RJ, Furman JM, Troutman-Enseki C, DeWolf RM, Marchetti G, Kontos AP. A Brief Vestibular/Ocular Motor Screening (VOMS) assessment to evaluate concussions: preliminary findings. Am J Sports Med. 2014 Oct;42(10):2479-86

VOMS
(Vestibular-ocular motor assessment)

- Record pre-test symptoms in the following areas: headache, dizziness, nausea, fogginess.
- Re-assess symptoms after testing



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Pictures from: https://www.upmcphysicianresources.com/cme-courses/active-management-of-ocular-problems-following-concussion

Management

Persistent Symptoms

- Persistent = symptoms > 4 weeks
- Patients will often have yellow flags
- Significant overlap with other conditions occurring after a traumatic experience.
  - Eg depression, anxiety, PTSD
  - Sequelae of pain related to comorbid conditions such as post-traumatic headache or whiplash-associated disorder

- Patricios JS, Schneider KJ, Dvorak J, et al. Consensus statement on concussion in sport: the 6th International Conference on Concussion in Sport–Amsterdam, October 2022. British Journal of Sports Medicine 2023;57:695-711.
- Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Symptom Treatment Hierarchy

- **Primary Symptoms (treat early)**

❑ **Headache**
  - **Neck pain**

❑ **Sleep disturbance**

❑ **Mood and anxiety disorders**

Silverberg ND, Iaccarino MA, Panenka WJ, et al. Management of Concussion and Mild Traumatic Brain Injury: A Synthesis of Practice Guidelines. *Arch Phys Med Rehabil*. 2020;101(2):382-393.

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Symptom Treatment Hierarchy

- **Secondary Symptoms**
- **Fatigue**
- **Balance issues /dizziness/tinnitus**
- **Visual dysfunction**
- **Cognitive symptoms**
- **Photophobia/ phonophobia**

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Education IS a/ the treatment

- **Early education** and reassurance regarding prognosis and recovery
  - Symptom-based strategies facilitate recovery (Level A*)
  - The majority of patients will achieve symptom resolution (Level A*)

- **Self management strategies**
  - Pacing and planning, regular breaks
  - Graduated return to exercise
  - Cognitive strategies
  - Sleep hygiene/CBTi
  - Stress reduction strategies (eg meditation, mindfulness)

* Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Concussion treatment is a team sport!

- Persistent Symptoms→ Early referral to interdisciplinary team (e.g. OT, physiotherapy, psychology, physiatry, psychiatry)
  - Level A recommendation*

* Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Headache Treatment

- **Headache → most common symptom** after mTBI
- Associated with a **high degree of disability**
- Affected by co-morbid conditions (eg mental health) and should not be treated in isolation
- Approach based on primary headache subtype
  - Mixed type headache is common
- Medication overuse headache very prevalent

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Headache Treatment

1. **Non pharmacological strategies**
   - Sleep, regular meals + hydration, stress reduction, exercise
   - Important to address the neck!
     - Early physiotherapy
2. **Pharmacological treatment**
   - Based on primary headache type
     - Tension headache
     - Migraine headache

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Tension Headache

- **Acute treatment** ** <15 days per month
  - NSAIDs
  - Tylenol
  - Combination analgesic (eg with caffeine) ** <10 days per month

- **Prophylaxis**
  - 1st line: TCA (amitriptyline or nortriptyline)
    - Amitriptyline helpful w/ concurrent **sleep** disturbance
  - 2nd line: Gabapentin, Venlafaxine XR
    - Venlafaxine helpful with concurrent **mood/anxiety** disturbance

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Migraine

- **Acute treatment**
  - NSAIDs/Tylenol ** <15 days per month
  - Triptans ** <10 days per month

- **Prophylaxis***
  - 1st line: TCA , Beta Blocker
    - Amitriptyline helpful w/ concurrent **sleep** disturbance
  - 2nd line: Topiramate, Gabapentin
    - Beware of cognitive s/e
  - Other: Venlafaxine (helpful with concurrent **mood/anxiety** disturbance)
  - Botox evidence in concussion less clear than for chronic migraine
  - Not much data re: CGRP antagonists yet in concussion
  - Supplements: CoQ10, B2, magnesium

Conidi, F.X. Interventional Treatment for Post-traumatic Headache. Curr Pain Headache Rep 20, 40 (2016)

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Sleep Disturbance

- Sleep disturbance after mTBI is very common
  - **>50 % of patients**
  - **Prognostic factor for functional outcomes at 1 year**
- *Acute stage* → increased need for sleep
- *Chronic stage* → **insomnia** most common disturbance
- Sleep disturbance **negatively affects many areas:**
  - mood, cognitive symptoms, social + occupational functioning
- Sleep disturbance can also be **secondary** to
  - Mental health conditions (anxiety, depression, PTSD)
  - Pain

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Sleep Disturbance

- Important to **rule out co-existing or pre-existing disorders**
  - E.g. OSA, restless leg syndrome, periodic limb movement disorder, REM sleep behaviour disorder
    - → Referral to sleep clinic for polysomnogram

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Treatment of Insomnia

- **Non pharmacological treatment**
  - CBTi (CBT for insomnia)
    - CBTi coach app
  - Sleep hygiene
  - Stimulus control
  - Time restriction in bed
  - Relaxation strategies/mindfulness based stress reduction
- **Pharmacological treatment**
  - Supplements
    - **Melatonin** (with reduced light in evening and blue light in AM)
    - Magnesium, Zinc (Limited data)
  - Trazodone
  - TCA (eg amitriptyline) → helpful for concurrent **headache**
  - Mirtazapine → helpful for concurrent **anxiety/depression** (off label: tension headache)
  - Prazosin (for concurrent **PTSD** + nightmares)

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Mental Health Disorders

- Mental health disorders **very common** post mTBI
- **Acute symptoms**: irritability, anxiety, emotional lability, depressed mood, apathy
- **Chronic conditions**: MDD, Anxiety disorders, Adjustment D/O, PTSD etc.
- Many contributing factors
  - Exacerbation of pre-existing condition
  - Stress + post-traumatic stress
  - Sleep disturbance
  - Chronic pain/headaches
  - Social isolation
  - Loss of occupation, financial difficulties
  - Pre-existing substance use disorders

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Treatment of depression and anxiety

- No evidence that depression or anxiety should be treated differently in mTBI
- Important to **rule out contributing medical conditions**
  - Anemia/iron deficiency
  - Thyroid dysfunction
  - B12 deficiency
- **Early referral to Psychiatry** for
  - Complex pre-existing mental health history,
  - Concurrent substance use d/o

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Treatment of depression and anxiety

- **Non pharmacological**
  - Counselling (**CBT : Level A**)
  - Mindfulness based stress reduction
- **Pharmacological**
  - **First line:**
    - **SSRI** (Sertraline, Citalopram most studied in mTBI)
      - Escitalopram, Fluoxetine
  - **Second line**
    - **SNRI**
      - Venlafaxine – helpful for concurrent **headache** prophylaxis
    - **Mirtazapine**
      - Helpful for concurrent **sleep disturbance** (and off label for tension h/a)
  - **AVOID:**
    - **Benzodiazepines** (dependence, neg effects on arousal, cognition, and motor coordination)
    - **Bupropion** (⬆ seizure risk)

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Killing 2 birds…

- **Amitriptyline**
  - Sleep disturbance and headache
- **Venlafaxine**
  - Anxiety/depression and headache
- **Mirtazapine**
  - Depression, sleep disturbance (off label, tension h/a)

Secondary Symptoms: *Fatigue*

- Common (~28% of patients at 3 months)
  - Fatigue at 3 months → more likely to persist at 6 months
- **Multifactorial** interplay:
  - Stress
  - Sleep disturbance
  - Mental health disturbance
  - Pain
- Important to **rule out and treat other causes**
  - TSH, CBC/ferritin, B12, A1c/FBG, lytes, Cr/GFR
- Gradual reintroduction of exercise important
  - Increase frequency, then duration, then intensity

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Secondary Symptoms: *Treatment of fatigue*

- Cognitive and physical **pacing, planning + proactive breaks**
  - **Occupational therapy treatment**
- Mindfulness Based Stress reduction (MBSR)
- Sleep hygiene
- Melatonin + reduced evening light +blue light therapy in AM
- Role of stimulants (eg methylphenidate , modafinil) debated
  - May lead to subsequent energy crash
  - Methylphenidate can be considered off-label in patients with persistent cognitive fatigue > 3 months

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Secondary Symptoms: *Dizziness and Vertigo*

- **Vestibular dysfunction**
  - **Peripheral**
    - **BPPV and otolith dysfunction (most common)**
    - VOR dysfunction (SCC dysfunction)
    - Labyrinthine concussion
    - Endolymphatic hydrops (post traumatic Meniere's)
    - Perilymphatic fistula/ SCC dehiscence
  - **Central**
    - White matter abnormalities (*DTI studies*)
    - Vestibular migraine
- **Other causes**
    - **Psychological** (anxiety often comorbid)
    - **Cervicogenic dizziness** (abnormal proprioceptive input from upper cervical spine efferents to vestibular nuclei)
    - **Orthostatic intolerance/ autonomic dysfunction**
- **Treatment**: **vestibular rehabilitation therapy** (**Physio**)
- Persistent symptoms, hearing loss
  - → **Referral to ENT, audiology**

Mucha A, Fedor S, DeMarco D. Vestibular dysfunction and concussion. Handb Clin Neurol. 2018;158:135-144

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Secondary Symptoms: *Tinnitus*

- Common symptom after a concussion
- Generally will resolve on its own
- No evidence for specific treatments
- Self management strategies
  - White noise
  - Brown noise
- If persistent, refer to ENT

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Secondary Symptoms: *Visual Dysfunction*

- **Visual Dysfunction**
  - **Impairments in**
    - Visual acuity
    - Accommodation
    - Versional (conjugate) eye movements
    - Vergence eye movements (**Convergence insufficiency**)
    - Visual fields
    - Photosensitivity
- Referral to optometry for complete visual exam helpful
- **Treatment**: **vision rehabilitation therapy** (optometry)
  - (controversial)
- Complex deficits, diplopia, persistent symptoms
  - → **Referral to Neuro-Ophthalmology**

Barton JJS, Ranalli PJ. Vision Therapy: Ocular Motor Training in Mild Traumatic Brain Injury. Ann Neurol. 2020;88(3):453-461

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Secondary Symptoms: **Cognitive Symptoms**

- Difficulties with
  - **attention/concentration**
  - **processing speed**
  - **learning/memory**
  - **executive function**
- Most improve and recover by **3-6 months**
- Persistent cognitive symptoms often influenced by **other factors**
  - Pain
  - Fatigue and sleep disturbance
  - Anxiety/depression, irritability
  - **Medications**
  - Psychological and personality factors

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Secondary Symptoms: **Cognitive Symptoms**

- Important to treat **primary symptoms/comorbid conditions**
- Early **education** and reassurance
- **Accommodations** at work/school
- Referral to **Occupational Therapy** for education and coaching
  - Compensatory cognitive strategies
  - CBT
  - Gradual return to work or school strategies
- Referral for neuropsychological assessment recommended for patients with:
  - Functionally limiting impairment
  - Persistent symptoms, despite appropriately treating comorbidities
  - No ongoing improvement
- **Symptoms should generally improve over time**
  - Worsening (especially in older patients) may NOT be concussion related (eg. screen for MCI/dementia)

Marshall S. et al (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org

Summary & Take Home Points

- Concussion is **a transient condition** with a good prognosis
  - **15-20% will have a complicated recovery**
    - Largely influenced by **"Yellow flags "**

- **Early education** and reassurance regarding prognosis and recovery is important!

- **Exercise** is an important treatment

→ **Relative rest only in first 24-48h**

- Increase activity by frequency, duration, intensity
- No more than 2 pts increase in symptoms on 0-10 scale
- Return to baseline symptoms <1 h

Summary & Take Home Points

- Focus on treatment of **primary symptoms first**
  - Headache
  - Sleep disturbance
  - Mood/anxiety disturbance

- Choose **medications that can treat multiple symptoms**
  - **Amitriptyline** → sleep and headache
  - **Venlafaxine** → headache and mood/anxiety
  - **Mirtazapine** → sleep and mood/anxiety (& tension headache)

Summary & Take Home Points

- **Concussion treatment is a team sport**
  - Early referral for patients with **persistent symptoms/yellow flags**
  - **Occupational Therapy** important for coaching:
    - Self-Management strategies
    - Graded exposure to stimuli
    - Return to activity
  - **Physiotherapy**:
    - Neck treatment and vestibular therapy
    - Return to exercise
  - **Psychiatry**
    - for complex mental health patients
  - **Psychology**
    - Counselling, CBT, Mindfulness
  - **Neuropsychology**
    - Persistent cognitive symptoms
  - **Optometry**
    - Complete visual examination, visual therapy
  - **ENT / Neuro-Ophthalmology**
    - for persistent vestibular, auditory / visual dysfunction

Resources for Clinicians and Patients

- **My Guide - Concussion VCH website:**
  - https://concussion.vch.ca/
  - https://teenconcussion.vch.ca/
- **Find a physiotherapist** (can search by area – eg vestibular)
  - https://bcphysio.org/find-a-physio
- **Find an occupational therapist (OT)**
  - https://caot.ca/site/findot
- **Parachute Canada Organization**
  - https://parachute.ca/en/injury-topic/concussion/ *(Includes return to work and school guidelines)*
- **Concussion Awareness Training Tool (CATT)**
  - https://cattonline.com/
- **Ontario Neurotrauma Foundation (ONF) Guidelines/Living Concussion Guidelines**
  - https://concussionsontario.org/
- **CBT for insomnia app**
  - https://www.ptsd.va.gov/appvid/mobile/cbticoach_app_public.asp

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Questions?

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TBI classification

	Mild TBI	Moderate TBI	Severe TBI
GCS	13–15	9–12	3–8
LOC	≤30 min	>30 min but <24 h	≥24 h
PTA	≤24 h	>24 h but <7 d	≥7 d
Imaging findings	No CT abnormalities	Abnormal CT findings	Abnormal CT findings

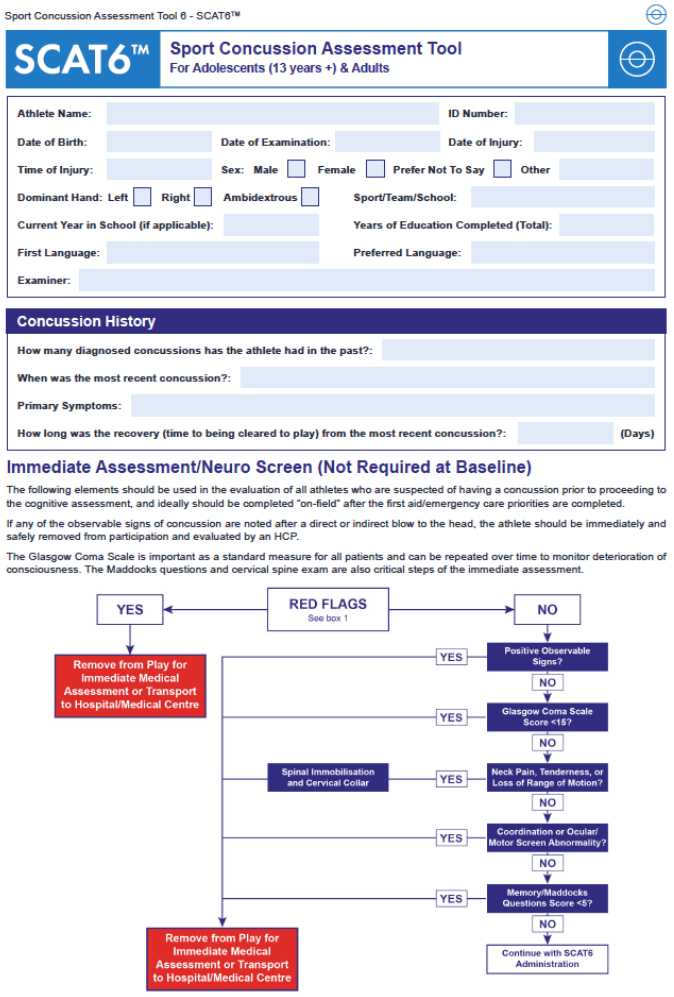
GCS, Glasgow coma scale; LOC, Loss of consciousness; PTA, Posttraumatic amnesia; TBI, Traumatic brain injury; min, minutes; h, hours; d, days; CT, Computed tomography.

Hu L, Yang S, Jin B, Wang C. Advanced Neuroimaging Role in Traumatic Brain Injury: A Narrative Review. Front Neurosci. 2022 Apr 13;16:872609

SCAT6 & Child SCAT6

(best <72h, up to 7d)

New in 2023



Sport Concussion Assessment Tool 6 - SCAT6™

SCAT6™ Sport Concussion Assessment Tool
For Adolescents (13 years +) & Adults

Athlete Name: ID Number:
Date of Birth: Date of Examination: Date of Injury:
Time of Injury: Sex: Male Female Prefer Not To Say Other
Dominant Hand: Left Right Ambidextrous Sport/Team/School:
Current Year in School (if applicable): Years of Education Completed (Total):
First Language: Preferred Language:
Examiner:

Concussion History

How many diagnosed concussions has the athlete had in the past?:
When was the most recent concussion?:
Primary Symptoms:
How long was the recovery (time to being cleared to play) from the most recent concussion?: (Days)

Immediate Assessment/Neuro Screen (Not Required at Baseline)

The following elements should be used in the evaluation of all athletes who are suspected of having a concussion prior to proceeding to the cognitive assessment, and ideally should be completed "on-field" after the first aid/emergency care priorities are completed.

If any of the observable signs of concussion are noted after a direct or indirect blow to the head, the athlete should be immediately and safely removed from participation and evaluated by an HCP.

The Glasgow Coma Scale is important as a standard measure for all patients and can be repeated over time to monitor deterioration of consciousness. The Maddocks questions and cervical spine exam are also critical steps of the immediate assessment.

For use by Health Care Professionals only

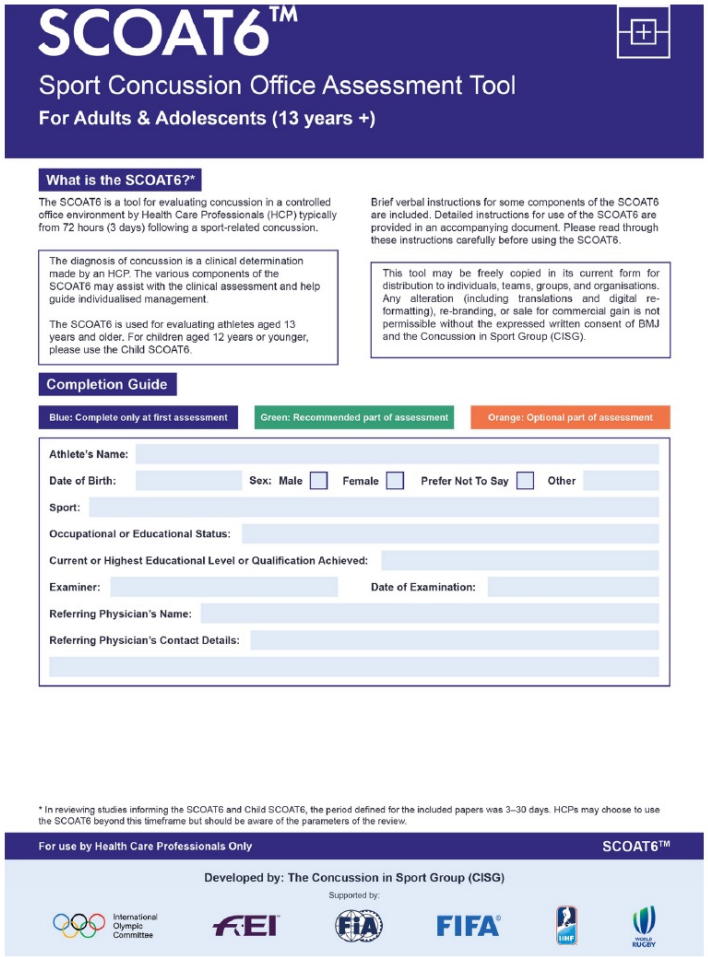
British Journal of Sports Medicine

Box 1 What's New?

⇒ Enhanced athlete demographic section.
⇒ The SCAT6 is for use in adolescents (>12 years), and adults. The Child SCAT6 is for use with children 8-12 years.
⇒ SCAT6 requires a minimum of 10–15 min to be performed correctly.
⇒ SCAT6 is to be used within 72 hours (3 days), and up to 7 days, following injury.
⇒ Revised recognise and remove section.
⇒ Revised immediate assessment/ neurological screen section.
⇒ New coordination and ocular/motor screen.
⇒ Enhanced Red Flags section.
⇒ Removal of the 'Read Aloud' instructions of the symptom scale.
⇒ Removal of the immediate memory 5-word list option (10-word list included).
⇒ Addition of a timed component to the months in reverse subtest.
⇒ Revised coordination and balance examination, including an optional dual-task tandem gait.
⇒ Revised detailed instruction section.

Standardized Office Assessment
(>72 h, < 30 d)

SCOAT6/Child SCOAT6
new in 2023



SCOAT6™

Sport Concussion Office Assessment Tool

For Adults & Adolescents (13 years +)

What is the SCOAT6?*

The SCOAT6 is a tool for evaluating concussion in a controlled office environment by Health Care Professionals (HCP) typically from 72 hours (3 days) following a sport-related concussion.

The diagnosis of concussion is a clinical determination made by an HCP. The various components of the SCOAT6 may assist with the clinical assessment and help guide individualised management.

The SCOAT6 is used for evaluating athletes aged 13 years and older. For children aged 12 years or younger, please use the Child SCOAT6.

Brief verbal instructions for some components of the SCOAT6 are included. Detailed instructions for use of the SCOAT6 are provided in an accompanying document. Please read through these instructions carefully before using the SCOAT6.

This tool may be freely copied in its current form for distribution to individuals, teams, groups, and organisations. Any alteration (including translations and digital re-formatting), re-branding, or sale for commercial gain is not permissible without the expressed written consent of BMJ and the Concussion in Sport Group (CISG).

Completion Guide

Blue: Complete only at first assessment | Green: Recommended part of assessment | Orange: Optional part of assessment

Athlete's Name:

Date of Birth: Sex: Male Female Prefer Not To Say Other

Sport:

Occupational or Educational Status:

Current or Highest Educational Level or Qualification Achieved:

Examiner: Date of Examination:

Referring Physician's Name:

Referring Physician's Contact Details:

* In reviewing studies informing the SCOAT6 and Child SCOAT6, the period defined for the included papers was 3–30 days. HCPs may choose to use the SCOAT6 beyond this timeframe but should be aware of the parameters of the review.

For use by Health Care Professionals Only SCOAT6™

Developed by: The Concussion in Sport Group (CISG)

Supported by:

International Olympic Committee FEI FIA FIFA IIHF World Rugby

Components:

- **History**
- **Medications**
- (Family history)
- **Symptom evaluation**
- **Verbal cognitive tests**
  - Immediate recall - 10 words
  - Concentration
    - Digits backwards,
    - Months in reverse
- **Exam**
  - Orthostatic vitals
  - Cervical spine
  - Neuro exam
  - Balance/tandem gait
  - Vestibulo-ocular motor screen
- **Delayed word recall**
- (Sleep, anxiety, depression screen)

Table 1 Return-to-learn (RTL) strategy

Step	Mental activity	Activity at each step	Goal
1	Daily activities that do not result in more than a mild exacerbation* of symptoms related to the current concussion	Typical activities during the day (eg, reading) while minimising screen time. Start with 5–15 min at a time and increase gradually.	Gradual return to typical activities
2	School activities	Homework, reading or other cognitive activities outside of the classroom.	Increase tolerance to cognitive work
3	Return to school part time	Gradual introduction of schoolwork. May need to start with a partial school day or with greater access to rest breaks during the day.	Increase academic activities
4	Return to school full time	Gradually progress in school activities until a full day can be tolerated without more than mild* symptom exacerbation.	Return to full academic activities and catch up on missed work

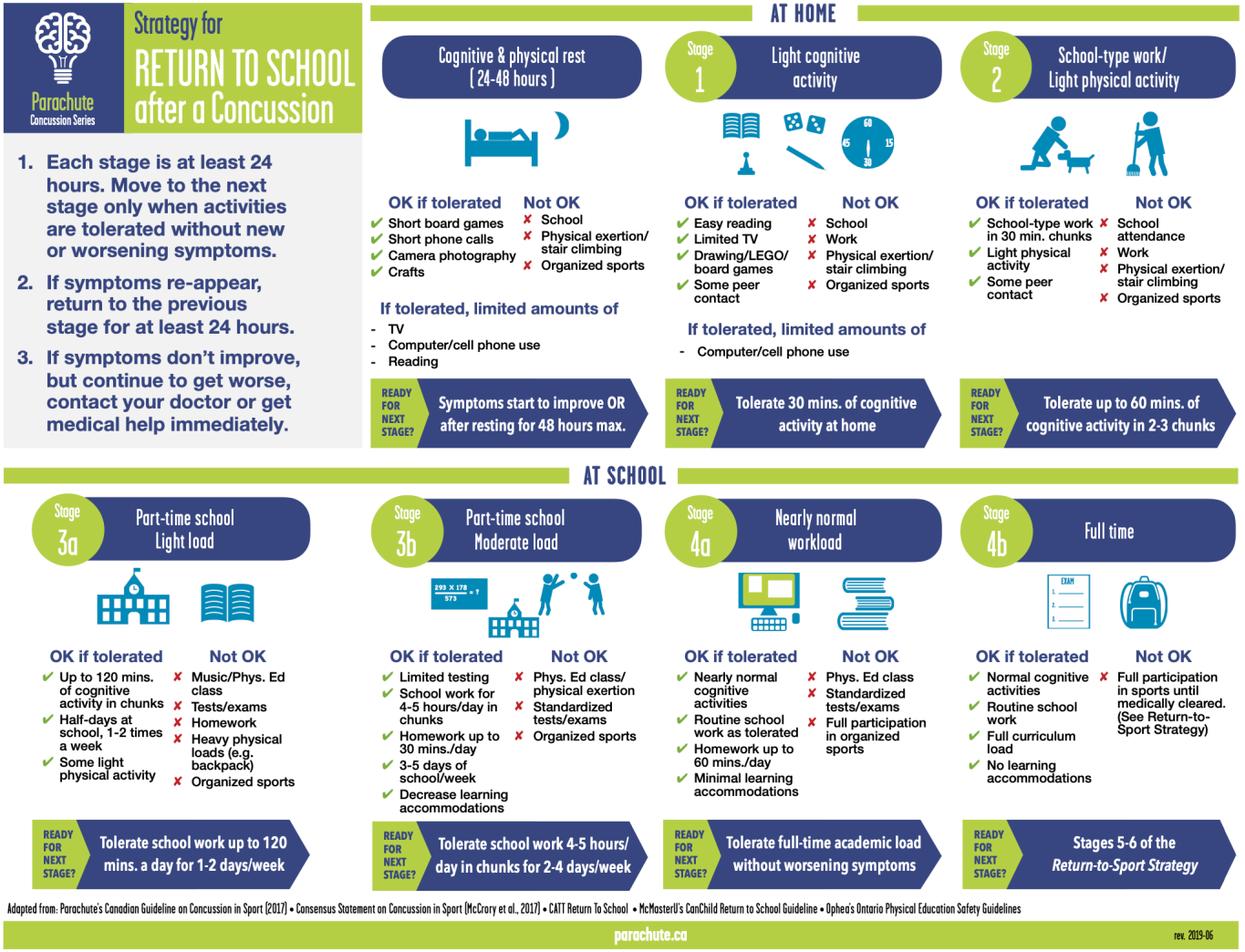
Following an initial period of relative rest (24–48 hours following an injury at Step 1), athletes can begin a gradual and incremental increase in their cognitive load. Progression through the strategy for students should be slowed when there is more than a mild and brief symptom exacerbation.
*Mild and brief exacerbation of symptoms is defined as an increase of no more than 2 points on a 0–10 point scale (with 0 representing no symptoms and 10 the worst symptoms imaginable) for less than an hour when compared with the baseline value reported prior to cognitive activity.

Return to Learn Strategy

Patricios JS, Schneider KJ, Dvorak J, et al. Consensus statement on concussion in sport: the 6th International Conference on Concussion in Sport–Amsterdam, October 2022. British Journal of Sports Medicine 2023;57:695-711.

Return to School Strategy

(Parachute Guidelines 2019)



Return to Work Strategy

(Parachute Guidelines 2019)

After a Concussion:

RETURN-TO-WORK STRATEGY

Parachute
Concussion Series

A concussion is a serious injury, but most people recover fully if their brain is given enough time to rest and recuperate.

Returning to your regular activities, including work, is a step-wise process that requires patience, attention, and caution.

In the Return-to-Work Strategy:

- **Each stage is at least 24 hours.**
- **Move on to the next stage when you tolerate activities without new or worsening symptoms.**
- **If any symptoms worsen, stop and go back to the previous stage for at least 24 hours.**

Stage 1: Initial cognitive and physical rest

After being diagnosed with a concussion, start with a short period of rest for 24 to 48 hours. Stay at home in a relaxing environment. Try simple activities such as drawing or listening to quiet music.

Stage 2: Light cognitive and physical activity

Add light activities, as long as they don't make your symptoms worse. Try simple chores at home, going for short walks, reading and using a screened device, such as a computer or tablet, for short periods. Be sure to take breaks and try to maintain a regular sleep schedule.

Stage 3: Prepare to return to work

Add more cognitive activity, and for longer periods of time, as tolerated. Continue building up your physical activity, such as running regular errands, gardening, jogging and light exercise. You can try your work commute to see how it makes you feel.

Contact your workplace to develop your individual, gradual return to work plan. The plan should consider the number of days and hours you will work, your workload, and your work environment (such as lighting and noise).

Stage 4: Reduced working hours with accommodations

Begin your return to work based on your plan. Use the accommodations you need, such as a quiet work station and regular breaks. Gradually increase working hours as long as your symptoms do not return or get worse.

Stage 5: Regular working hours with accommodations

Gradually decrease accommodations as tolerated. Be aware of how much energy you have left after the work day for household and social activities.

Stage 6: Return to work

Full return to your regular work schedule without accommodations.

Important: If the work you do can put your safety or the safety of others at risk, get medical clearance before returning to those tasks. Examples include operating heavy machinery, driving for long periods of time or working at heights.

Return to Sport Strategy

Table 2 Return-to-sport (RTS) strategy—each step typically takes a minimum of 24 hours

Step	Exercise strategy	Activity at each step	Goal
1	Symptom-limited activity	Daily activities that do not exacerbate symptoms (eg, walking).	Gradual reintroduction of work/school
2	Aerobic exercise **2A—Light** (up to approximately 55% maxHR) **then** **2B—Moderate** (up to approximately 70% maxHR)	Stationary cycling or walking at slow to medium pace. May start light resistance training that does not result in more than mild and brief exacerbation* of concussion symptoms.	Increase heart rate
3	Individual sport-specific exercise Note: If sport-specific training involves any risk of inadvertent head impact, medical clearance should occur prior to Step 3	Sport-specific training away from the team environment (eg, running, change of direction and/or individual training drills away from the team environment). No activities at risk of head impact.	Add movement, change of direction
Steps 4–6 should begin after the resolution of any symptoms, abnormalities in cognitive function and any other clinical findings related to the current concussion, including with and after physical exertion.			
4	Non-contact training drills	Exercise to high intensity including more challenging training drills (eg, passing drills, multiplayer training) can integrate into a team environment.	Resume usual intensity of exercise, coordination and increased thinking
5	Full contact practice	Participate in normal training activities.	Restore confidence and assess functional skills by coaching staff
6	Return to sport	Normal game play.	

*Mild and brief exacerbation of symptoms (ie, an increase of no more than 2 points on a 0–10 point scale for less than an hour when compared with the baseline value reported prior to physical activity). Athletes may begin Step 1 (ie, symptom-limited activity) within 24 hours of injury, with progression through each subsequent step typically taking a minimum of 24 hours. If more than mild exacerbation of symptoms (ie, more than 2 points on a 0–10 scale) occurs during Steps 1–3, the athlete should stop and attempt to exercise the next day. Athletes experiencing concussion-related symptoms during Steps 4–6 should return to Step 3 to establish full resolution of symptoms with exertion before engaging in at-risk activities. Written determination of readiness to RTS should be provided by an HCP before unrestricted RTS as directed by local laws and/or sporting regulations.

HCP, healthcare professional; maxHR, predicted maximal heart rate according to age (ie, 220-age).

Patricios JS, Schneider KJ, Dvorak J, et al. Consensus statement on concussion in sport: the 6th International Conference on Concussion in Sport–Amsterdam, October 2022. British Journal of Sports Medicine 2023;57:695-711.