TEXAS CHILDREN'S HOSPITAL
EVIDENCE-BASED OUTCOMES CENTER
Evaluation and Management of Pediatric Concussion
Multi-Disciplinary Consensus Clinical Pathway

Inclusion Criteria
- Children 5 to 21 years of age with a suspected concussion
- Glasgow Coma Scale score (GCS) ≥13

Exclusion Criteria
- Clinically significant Traumatic Brain Injury (ie: Intracranial hemorrhage, Diffuse Axonal Injury)
- GCS <13
- Focal neurologic deficits
- Patients with traumatic injuries requiring hospital admission
- Suspicion of abuse

For additional resources (i.e., symptom inventory checklists, screening tools, Return to Play algorithms, provider education, etc.…)
PCSI, VOMS,
see TCH Concussion Webpage

Acute Symptom Control ***

Nausea / Vomiting:
Zofran

Headache
Nsaids, Tylenol - 1st Line
Migraine Protocol- 2nd Line

Risks for patients who may require further referral/consultation:
- Prior history of concussions
- Lower cognitive ability / Learning Disabilities/Differences
- Underlying neurological or mental health disorder (i.e., depression, anxiety disorders, etc…)
- Family and social stressors
- At high risk for recurrent concussion, engaged in competitive sports or physical fine arts

EC, UC or TCP
Child with acute head injury with low suspicion of clinically significant TBI or intracranial hemorrhage
******Please review Trauma Closed Head Injury Guideline by clicking here*****
See algorithm for Pediatric Concussion Follow-Up

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History and Physical
- Use a standardized evaluation tool if possible
- Examples: Age appropriate symptom inventory (e.g. PCSI-P, PCSI 5-12, PCSI 13-18) or Sideline Concussion Assessment Tool (SCAT)

Concussion Targeted History:
Identify risk-factors that could suggest prolonged symptoms-
- Medical history: Neurologic disorder, mental health disorder
- Educational History: Learning disabilities/differences
- Concussion history: Mulitple or prolonged concussion(s)

Concussion signs/symptoms:
- Headaches, 'pressure in head', neck pain, nausea/vomiting, dizziness, blurred vision, balance problems, sensitivity to light, sensitivity to noise, feeling slowed down, feeling 'in a fog', 'don't feel right', difficulty concentrating, difficulty remembering, fatigue, low energy, confusion, drowsiness, more emotional, irritability, sadness, nervous/anxious, trouble falling asleep

Concussion Targeted Physical exam:
- Full vital signs
- Assessment of pain using validated, age/developmental-appropriate pain scale
- Consider full GCS exam
- Neurologic Assessment (cranial nerves, motor, sensory, reflex, cerebellar, mental status)
- Specific evaluation for neck injury (Cervical tenderness and/or neck ROM)
- Evaluate balance (e.g. Rhomberg, Tandem gait, or BESS- Balance Error Scoring System)
- Consider Vision/Vestibular Evaluation (e.g. VOMS- Vestibular/Ocular-Motor Screening)

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Acute Symptom Control***

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Discharge

Discharge Criteria:
- Symptoms controlled (including vomiting and pain)
- No injuries or medical conditions warranting admission or further evaluation
- Capable caretakers who can reliably observe the child and who can return for care if indicated

Follow up:
- Initial evaluation: 2-3 days with primary care provider
- Follow-up evaluations: q1-2 weeks
- See risk table for patients that may require further referral or consultation (see table****)

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Referral/Consultation Table ****

Service	Indication for Referral
Sports Medicine	High-level athletes No improvement or poor improvement after 2-3 weeks High risk for prolonged concussion
Neuroimaging	Acutely worsening symptoms
Neurology	Severe or worsening headache and associated symptoms lasting >3 weeks or headache lasting ≥3 months after injury Concussion complicated by underlying chronic neurologic issues
Neurosurgery	Evidence or suspicion of cervical spine injury (e.g., Spear Tackler's Spine) Evidence of structural brain injury
Physical Medicine & Rehabilitation	Persistent motor, sensory or integration problems Cervicogenic headache
Pediatric Neuropsychology	Evaluation of cognitive effects of multiple concussions Evidence of diminished academic performance Persistent behavioral/affective symptoms Persistent abnormal computerized neuro-psychology testing (e.g., ImPACT) Symptoms not improving due to comorbid conditions including ADHD, LD, and/or ASD
Physical Therapy or Occupational Therapy	Persistent and clinically significant Vestibular/Ocular-Motor dysfunction (>2-3 weeks) Cervical segmental dysfunction Reconditioning (if needed for prolonged concussions)
Otolaryngology	Persistent balance or hearing problems
Sleep Medicine	Persistent sleep disturbances and/or insomnia
Social Work	Consider consultation for concussions related to school violence and/or bullying

Discharge Education

Instruct caregivers to watch for potential warning signs
- Worsening headache
- Significant nausea and/or repeated vomiting
- Increased confusion, restlessness, or agitation
- Slurred speech, drowsiness, or inability to wake up
- Weakness, numbness of decreased coordination
- Loss of consciousness, convulsions or seizures

Cognitive rest
- Some patients require a 24-48 hour break from school after a concussion. Prolonged rest beyond the first 24-48 hours after a concussion is no longer routinely recommended and may be associated with a delayed recovery.
- Limit hand-held devices and video games if symptoms increase. This is especially important in patients with light sensitivity and oculomotor dysfunction.

Physical rest
- After an initial 24-48 hour rest, a progressive return to activities can be initiated if symptoms are improving
- Patients may begin light physical activity (example: 20 minute walk) even if symptoms are present as long as the activity is tolerated and symptoms are not worsening
- Children and adolescents should return to full school participation before they return to full athletic participation.
- Clearance will be needed by a provider prior to participation in organized, full-contact sports

Pain management
- 1st line – OTC pain meds (acetaminophen, ibuprofen, naproxen)
- 2nd line – prescription pain meds (NSAIDs); *use of NSAIDs > 2 weeks for pain control beyond 3 consecutive weeks will likely evolve to medication overuse headache (another type of secondary headache that requires drug withdrawal).*
- Use of prescription pain meds like synthetic opiates, tramadol, etc., is at the discretion of the physician, keeping in mind that severe headache or neck pain may indicate a diagnosis other than concussion.

Follow-Up Care

Initial Evaluation: Follow-up after initial evaluation should be within 2-3 days with PCP.
Specialist Referrals: See Table****

Follow-up Evaluations: Follow-up for subsequent evalautions are usually every 1-2 weeks.
Strongly consider a referral for patients whose symptoms do not improve as expected after 2-3 weeks (see Referral Table****)

See **Progressive Return to Activities (Learning and Athletic) Algorithm** for recommendations on returning patients to academic and physical activity participation

TEXAS CHILDREN'S HOSPITAL
EVIDENCE-BASED OUTCOMES CENTER
Pediatric Progressive Return to Activities (Learning and Athletic)

Progressive Return to Activities (Learning and Athletic)

Example:
Return to School/Activities Concussion Return to Learning Plan (Steps 1-5) and then Return to Athletics (Steps 6-10)

Step 1- Full Brain Rest
- Some patients require a 24-48 hour break from school after a concussion. Prolonged rest beyond the first 24-48 hours after a concussion is no longer routinely recommended and may be associated with a delayed recovery.
- Academics- No school. No reading.
- Electronics- No Screen Time (TV, IPad, Texting,...)
- Activity- Walking for up to 20 minutes if no increase in symptoms
- No Competitive Sports or PE
- Rest is the key at this level.

Step 2- Home Brain Rest
- Academic- No school. Light reading is okay. Light mental activities.
- Electronics- Must take a break for every 15 minutes of screen time
- Be careful about action movies and video games
- Activity- Walking for up to 20 minutes if no increase in symptoms
- No competitive sports or PE

Step 3- Half-day of school
- Academics- 1/2 day of school
- Minimize Exams. Extra time for assignments
- Try to minimize busy work and focus on important concepts
- Schedule breaks when studying (example: 5 minute break for every 15 minutes of studying at home or study hall)
- Electronics- Take a short break for every 15 minutes of screen time, but try to minimize electronics. Stop if symptoms worsen.
- Activity- Walking for up to 20 minutes if no increase in symptoms
- No competitive sports, PE, or band (rest or study instead of PE or band)

Step 4- Full Day of School and Light Aerobic Activity (light=low intensity)
- Academics- Full day of school
- Consider scheduled break at lunch and PE
- Minimize exams. Extra time for assignments
- Try to minimize busy work and focus on important concepts
- Electronics- Take a short break for every 15 minutes of screen time, but try to minimize electronics. Stop if symptoms worsen
- Activity- Walking for up to 20 minutes if no increase in symptoms (OK to do light aerobic exercise like jogging or exercise biking at this stage if tolerated)
- No competitive sports, PE, or band (rest or study instead of PE or band)

Step 5- Full Academics (become a fully functional normal student)
- Academics- Full day of school
- Full Exams and assignments
- Electronics- No restrictions
- Activity- Walking for up to 20 minutes if no increase in symptoms (OK to do light aerobic exercise like jogging or exercise biking at this stage if tolerated)
- No competitive sports.
- May start a return to competitive Athletics after completing this step

Note: *Usually the patient needs a normal exam and symptoms back to baseline before progressing to steps 6-10 (Return to Athletics Progression)*

Step 6- High **Aerobic Activities** (high=higher intensity)
- Light aerobic exercise such as walking, jogging, or stationary cycling.
- No resistance training.

Step 7- Heavy Aerobic/Weights Activities
- Sport specific exercise (e.g. Running/sprinting). May start progressive addition of resistance training at this step.

Step 8- Non-contact practice
- Progress to non-contact training drills
- Examples:
  - Passing drills in soccer or football
  - Jumping in cheerleading (no tumbling or flying)

Step 9- Full contact practice
- Full contact practice after medical clearance (not until cleared by a provider)
- **Step 10- Game play and full participation**

Symptoms Specific Treatments

Light Sensitivity: Sun glasses, decrease brightness of computer screen
Noise: Quiet environment, noise canceling headphones/ear buds
Fatigue: Frequent breaks, mild physical activities (walks, stretch breaks), sleep hygiene
Symptoms exacerbation with school work: Extra time for tests, less repetitive work (focus on concepts), consider blue light glasses for screens
Symptoms worsen with reading: Decrease reading assignments (books on tape), pre-printed notes, Larger print, reading glasses
School Anxiety: Clear expectations for when work is due, access resources in the school if available
Depressed mood: Get help early (Counseling, psychologist/psychiatry teams), consider depression screening

Academic Accommodations

- No school, ½ days, vs Full days
- Testing vs no testing
- Academic accommodations examples: Extra time for exams/ quizzes, reduced workload, pre-printed notes, focus on core concepts

Note: *Try to avoid prolonged school absences*
Consider having a pre-designed letter for academic accommodations

Sample Note for Accommodations (designed for EPIC):

I saw and evaluated @NAME@ for concussion. I am requesting accommodations for school due to the injury. For recovery from post-concussive symptoms, cognitive rest is needed in this case. My recommendations would be the following:

School Time
__ Full Days as tolerated
__ Half Days as tolerated
__ No school and may return on ___ for half days

Academic Accommodations

__ Postpone Examinations
__ No more than ___ exams a week
__ Unlimited time on tests/assignments
__ Reduced work load (1/2 of the usual load)
__ Obtain notes for class from peers or have pre-printed notes/ handouts
__ Make up missed assignments gradually

Athletics
(before progressive to athletic participation, the patient's symptoms should be back to baseline and he/she should be cleared academically)

__ No PE, gym, or athletics.

__ Cleared to start a progressive return to activites under supervision
Light Aerobic
Heavy Aerobic/Weights
Non-contact practice
Full contact practice
Game play/Full particpation

__ Full clearance for PE/Sports/Activities

I would like to continue to follow @NAME@ until the concussion symptoms and post-concussive symptoms are resolved. I appreciate your assistance as @FNAME@ returns to school and activities.
Thank you.

Clinical Standards Preparation

This clinical standard was prepared by the Evidence-Based Outcomes Center (EBOC) team in collaboration with content experts at Texas Children's Hospital. Development of this clinical standard supports the TCH Quality and Patient Safety Program initiative to promote clinical standards and outcomes that build a culture of quality and safety within the organization.

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No relevant financial or intellectual conflicts to report.

Development Process

This clinical standard was developed using the process outlined in the EBOC Manual. The literature appraisal documents the following steps:

1. Review Preparation
   - PICO questions established
   - Evidence search confirmed with content experts
2. Review of Existing External Guidelines
   - Guideline on the Diagnosis and Management of Mild Traumatic Brain Injury Among Children
   - ED Clinical Pathway for Evaluation/Treatment of Acute Head Trauma
   - Concussion Clinical Care Guideline/ Pathway
   - Guidelines for Diagnosing and Managing Pediatric Concussion
3. Literature Review of Relevant Evidence
   - Searched: PubMed, CINAHL, Cochrane
4. Critically Analyze the Evidence
   - Little to no available evidence; recommendations adopted or adapted from the CDC Pediatric mTBI Guideline
5. Summarize the Evidence
   - Materials used in the development of the clinical standard, literature appraisal, and any order sets are maintained in a mild traumatic brain injury evidence-based review manual within EBOC.

Evaluating the Quality of the Evidence

Published clinical guidelines were evaluated for this review using the **AGREE II** criteria. The summary of these guidelines are included in the literature appraisal. AGREE II criteria evaluate Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity and Presentation, Applicability, and Editorial Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.

This clinical standard specifically summarizes the evidence *in support of* or *against* specific interventions and identifies where evidence is *lacking/inconclusive*. The following categories describe how research findings provide support for treatment interventions.

"Evidence Supports" provides evidence to support an intervention
"Evidence Against" provides evidence against an intervention.
"Evidence Lacking/Inconclusive" indicates there is insufficient evidence to support or refute an intervention and no conclusion can be drawn *from the evidence*.

The **GRADE** criteria were utilized to evaluate the body of evidence used to make practice recommendations. The table below defines how the quality of the evidence is rated and how a strong versus weak recommendation is established. The literature appraisal reflects the critical points of evidence.

Recommendation	
STRONG	Desirable effects clearly outweigh undesirable effects or vice versa
WEAK	Desirable effects closely balanced with undesirable effects
Quality	**Type of Evidence**
High	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies
Moderate	Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies
Low	Evidence for at least 1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence
Very Low	Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence

Recommendations

Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible. The Content Expert Team and EBOC team remain aware of the controversies in the diagnosis/management of mild traumatic brain injury in children. When evidence is lacking, options in care are provided in the clinical standard and the accompanying order sets (if applicable).

Approval Process

Clinical standards are reviewed and approved by hospital committees as deemed appropriate for its intended use. Clinical standards are reviewed as necessary within EBOC at Texas Children's Hospital. Content Expert Teams are involved with every review and update.

Disclaimer

Practice recommendations are based upon the evidence available at the time the clinical standard was developed. Clinical standards (guidelines, summaries, or pathways) do not set out the standard of care and are not intended to be used to dictate a course of care. Each physician/practitioner should use his or her independent judgment in the management of any specific patient and is responsible, in consultation with the patient and/or the patient's family, to make the ultimate judgment regarding care.

Permission of Use

Version History

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