**ACUTE CONCUSSION EVALUATION (ACE)**

Physician/Clinician Office Version
Gerard Gioia, PhD¹ & Micky Collins, PhD²

¹Children's National Medical Center
²University of Pittsburgh Medical Center

---

### A. Injury Characteristics

<table>
<thead>
<tr>
<th>Date/Time of Injury</th>
<th>Reporter: <strong>Patient</strong> <strong>Parent</strong> <strong>Spouse</strong> <strong>Other</strong></th>
</tr>
</thead>
</table>

1. Injury Description _____________________________________________________________

- Is there evidence of a forcible blow to the head (direct or indirect)?
  - Yes
  - No
  - Unknown
- Is there evidence of intracranial injury or skull fracture?
  - Yes
  - No
  - Unknown
- Location of Impact: 
  - Frontal
  - Lft Temporal
  - Rt Temporal
  - Lft Parietal
  - Rt Parietal
  - Occipital
  - Neck
  - Indirect Force

2. Cause: 
  - MVC
  - Pedestrian-MVC
  - Fall
  - Assault
  - Sports
  - Other
  - Specify__________________________

---

### B. Symptom Check List

Since the injury, has the person experienced any of these symptoms any more than usual today or in the past day?

<table>
<thead>
<tr>
<th>PHYSICAL (10)</th>
<th>COGNITIVE (4)</th>
<th>SLEEP (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>Feeling mentally foggy</td>
<td>Drowsiness</td>
</tr>
<tr>
<td>Nausea</td>
<td>Feeling slowed down</td>
<td>Sleeping less than usual</td>
</tr>
<tr>
<td>Vomiting</td>
<td>Difficulty concentrating</td>
<td>Sleeping more than usual</td>
</tr>
<tr>
<td>Balance problems</td>
<td>Difficulty remembering</td>
<td>Trouble falling asleep</td>
</tr>
<tr>
<td>Dizziness</td>
<td>COGNITIVE Total (0-4)</td>
<td>SLEEP Total (0-4)</td>
</tr>
<tr>
<td>Visual problems</td>
<td>EMOTIONAL (4)</td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td>Irritability</td>
<td></td>
</tr>
<tr>
<td>Sensitivity to light</td>
<td>Sadness</td>
<td></td>
</tr>
<tr>
<td>Sensitivity to noise</td>
<td>More emotional</td>
<td></td>
</tr>
<tr>
<td>Numbness/Tingling</td>
<td>Nervousness</td>
<td></td>
</tr>
<tr>
<td>PHYSICAL Total (0-10)</td>
<td>EMOTIONAL Total (0-4)</td>
<td></td>
</tr>
</tbody>
</table>

(Add Physical, Cognitive, Emotional, Sleep totals)

Total Symptom Score (0-22) __________

---

### C. Risk Factors for Protracted Recovery

(check all that apply)

- Concussion History? Y ___ N ___
- Headache History? Y ___ N ___
- Developmental History
- Psychiatric History

**Exertion:** Do these symptoms worsen with:

- Physical Activity __Yes__ __No__ __N/A__
- Cognitive Activity __Yes__ __No__ __N/A__

**Overall Rating:** How different is the person acting compared to his/her usual self? (circle)

- Normal 0 1 2 3 4 5 6 Very Different

---

### D. RED FLAGS for acute emergency management:

Refer to the emergency department with sudden onset of any of the following:

- * Headaches that worsen
- * Looks very drowsy/ can’t be awakened
- * Can’t recognize people or places
- * Neck pain
- * Seizures
- * Repeated vomiting
- * Increasing confusion or irritability
- * Unusual behavioral change
- * Focal neurologic signs
- * Slurred speech
- * Weakness or numbness in arms/legs
- * Change in state of consciousness

---

### E. Diagnosis (ICD-10):

- __Concussion w/o LOC S06.0X0A__
- __Concussion w/ LOC S06.0X1A__
- __Concussion (Unspecified) S06.0X9A__
- __Other (854)__
- __No diagnosis__

---

### F. Follow-Up Action Plan

Complete ACE Care Plan and provide copy to patient/family.

- No Follow-Up Needed
- Physician/ Clinician Office Monitoring: Date of next follow-up ____________
- Referral:
  - Neuropsychological Testing
  - Physician: Neurosurgery __Neurology__ __Sports Medicine__ __Physiatrist__ __Psychiatrist__ __Other__
  - Emergency Department

ACE Completed by: ____________________________ MD RN NP PhD ATC

© Copyright G. Gioia & M. Collins, 2006 v2
A concussion (or mild traumatic brain injury (MTBI)) is a complex pathophysiologic process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces to the head. Disturbance of brain function is related to neurometabolic dysfunction, rather than structural injury, and is typically associated with normal structural neuroimaging findings (i.e., CT scan, MRI). Concussion may or may not involve a loss of consciousness (LOC). Concussion results in a constellation of physical, cognitive, emotional and sleep-related symptoms. Symptoms may last from several minutes to days, weeks, months or even longer in some cases.

ACE Instructions

The ACE is intended to provide an evidence-based clinical protocol to conduct an initial evaluation and diagnosis of patients (both children and adults) with known or suspected MTBI. The research evidence documenting the importance of these components in the evaluation of an MTBI is provided in the reference list.

A. Injury Characteristics:

1. Obtain description of the injury - how injury occurred, type of force, location on the head or body if force transmitted to head. Different biomechanics of injury may result in differential symptom patterns (e.g., occipital blow may result in visual changes, balance difficulties).

2. Indicate the cause of injury. Greater forces associated with the trauma are likely to result in more severe presentation of symptoms.

3. Amnesia: Amnesia is defined as the failure to form new memories. Determine whether amnesia has occurred and attempt to determine length of time of memory dysfunction – before (retrograde) and after (anterograde) injury. Even seconds to minutes of memory loss may be predictive of outcome. Recent research has indicated that amnesia may be up to 4-10 times more predictive of symptoms and cognitive losses following concussion than is LOC (less than 1 minute).1

4. Loss of consciousness (LOC) - If occurs, determine length of LOC.

5. Early signs. If present, ask the individuals who know the patient (parent, spouse, friend, etc) about specific signs of the concussion/MTBI that may have been observed. These signs are typically observed early after the injury.

6. Inquire whether seizures were observed or not.

B. Symptom Checklist: 2

1. Ask patient (and/ or parent, if child) to report presence of the four categories of symptoms since injury. It is important to assess all listed symptoms as different parts of the brain control different functions. One or all symptoms may be present depending upon mechanisms of injury.2 Record 1 for Yes or 0 for No for their presence or absence, respectively.

2. For all symptoms, indicate presence of symptoms as experienced within the past 24 hours. Since symptoms can be present premorbidly/ at baseline (e.g., inattention, headaches, sleep, sadness), it is important to assess change from their typical presentation.

3. Scoring: Sum total number of symptoms present per area, and sum all four areas into Total Symptom Score (score range 0-22). (Note: most sleep symptoms are only applicable after a night has passed since the injury. Drowsiness may be present on the day of injury.) If symptoms are new and present, there is no lower limit symptom score. Any score > 0 indicates positive symptom history.

4. Exertion: Inquire whether any symptoms worsen with physical (e.g., running, climbing stairs, bike riding) and/or cognitive (e.g., academic studies, multi-tasking at work, reading or other tasks requiring focused concentration) exertion. Clinicians should be aware that symptoms will typically worsen or re-emerge with exertion, indicating incomplete recovery. Over-exertion may protract recovery.

5. Overall Rating: Determine how different the person is acting from their usual self. Circle 0 (Normal) to 6 (Very Different).

C. Risk Factors for Protracted Recovery: Assess the following risk factors as possible complicating factors in the recovery process.

1. Concussion history: Assess the number and date(s) of prior concussions, the duration of symptoms for each injury, and whether less biomechanical force resulted in re-injury. Recent research indicates that cognitive and symptom effects of concussion may be cumulative, especially if there is minimal duration of time between injuries and less biomechanical force results in subsequent concussion (which may indicate incomplete recovery from initial trauma).4,8

2. Headache history: Assess personal and/or family history of diagnosis/treatment for headaches. Recent research indicates headache (migraine in particular) can result in protracted recovery from concussion.8,11

3. Developmental history: Assess history of learning disabilities, Attention-Deficit/Hyperactivity Disorder or other developmental disorders. Recent studies indicate the possibility of a longer period of recovery with these conditions.12

4. Psychiatric history: Assess for history of depression/mood disorder, anxiety, and/ or sleep disorder.13-16

D. Red Flags: The patient should be carefully observed over the first 24-48 hours for these serious signs. Red flags are to be assessed as possible signs of deteriorating neurological functioning. Any positive report should prompt strong consideration of referral for emergency medical evaluation (e.g. CT Scan to rule out intracranial bleed or other structural pathology).7

E. Diagnosis: The following ICD-10 diagnostic codes may be applicable.

S06.0XA (Concussion, with no loss of consciousness) – Positive injury description with evidence of forcible direct/ indirect blow to the head (A1a); plus evidence of active symptoms (B) of any type and number related to the trauma (Total Symptom Score >0); no evidence of LOC (A5), skull fracture or intracranial injury (A1b).

S06.0XA1 (Concussion, with brief loss of consciousness < 30 minutes) - Positive injury description with evidence of forcible direct/ indirect blow to the head (A1a); plus evidence of active symptoms (B) of any type and number related to the trauma (Total Symptom Score >0); positive evidence of LOC (A5), skull fracture or intracranial injury (A1b).

S06.0XA9 (Concussion, unspecified) - Positive injury description with evidence of forcible direct/ indirect blow to the head (A1a); plus evidence of active symptoms (B) of any type and number related to the trauma (Total Symptom Score >0); unclear/unknown injury details; unclear evidence of LOC (A5), no skull fracture or intracranial injury.

Other Diagnoses – If the patient presents with a positive injury description and associated symptoms, but additional evidence of intracranial injury (A1b) such as from neuroimaging, a moderate TBI and the diagnostic category of S06.890A (Intracranial injury) should be considered.

F. Follow-Up Action Plan: Develop a follow-up plan of action for symptomatic patients. The physician/clinician may decide to (1) monitor the patient in the office or (2) refer them to a specialist. Serial evaluation of the concussion is critical as symptoms may resolve, worsen, or ebb and flow depending upon many factors (e.g., cognitive/ physical exertion, comorbidities). Referral to a specialist can be particularly valuable to help manage certain aspects of the patient's condition. (Physician/clinician should also complete the ACE Care Plan included in this tool kit.)

1. Physician/clinician serial monitoring- Particularly appropriate if number and severity of symptoms are steadily decreasing over time and/or fully resolve within 3-5 days. If steady reduction is not evident, referral to a specialist is warranted.

2. Referral to a specialist – Appropriately if symptom reduction is not evident in 3-5 days, or sooner if symptom profile is concerning in type/severity.

    • Neuropsychological Testing can provide valuable information to help assess a patient’s brain function and impairment and assist with treatment planning, such as return to play decisions.

    • Physician Evaluation is particularly relevant for medical evaluation and management of concussion. It is also critical for evaluating and managing focal neurologic, sensory, vestibular, and motor concerns. It may be useful for medication management (e.g., headaches, sleep disturbance, depression) if post-concussive problems persist.