SUSPECTED CONCUSSION

EXECUTIVE SUMMARY

Physician Owner: Dr. Kody Moffatt

Primary Objective

Develop a pathway that aides in recognizing, treating, and managing concussion related symptoms until child can fully return to academic and physical activities.

Recommendations

Inclusion Criteria:

- Children ≥ 8years of age with head, neck, or body trauma clinically suspected of having a concussion within 4 weeks of injury

Exclusion Criteria:

- Children < 8 years of age
- Focal neurological deficits
  - Consider acute stroke pathway when symptoms have been present for < 24 hours
- Change in mental status
- Potential spinal injury
- Progressive, worsening symptoms or new neurological signs
- Persistent vomiting
- Evidence of skull fracture
- Post traumatic seizures
- Coagulopathy
- History of neurosurgery (e.g., shunt)
- Polytrauma
- Bleeding around or within the brain (subdural hematoma, epidural hematoma, intraparenchymal hemorrhage, etc.)

Presentation: [12,9]

- Clinicians should consider concussion in patients who present with trauma to the head, neck or body. Common features that may be utilized in clinically defining the nature of a concussive head injury include:
  - Concussion may be caused by either a direct blow to the head, face neck or elsewhere on the body with an "impulsive" force transmitted to the head.
  - Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously. However, in some cases, signs and symptoms may evolve over several minutes to hours.
  - Concussion may result in neuropathological changes, but the acute clinical signs and symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.
  - Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive features typically follows a sequential course. However, in some cases symptoms may be prolonged.

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Assessment:

- Review signs & symptoms for concussion[12,9]:
  - Glasgow coma scale (GCS) when patient presents immediately after injury (See Appendix A)
    - All patients with a GCS < 15 should be sent to the ED (if not already there)
  - Graded symptom check list (See Appendix B)
    - Another clinically acceptable alternative to the graded system checklist is to utilize the Sport Concussion Office Assessment Tool-6th Ed. SCOAT6 (SCOAT6) for children 8-12 years of age. The SCOAT6 tool includes a symptom checklist, cognitive assessment, and a physical exam. However, to accurately complete the SCOAT6 tool it takes a minimum of 20 minutes and its utility decreases significantly 3-5 days post injury. The SCOAT 6 linked here is for 13 years and older.
    - Cognitive assessment
- Perform physical exams:
  - Neck exam
  - Manual muscle testing
  - Balance exam
  - Consider coordination exam
  - Modified Vestibular Ocular Motor Screening (mVOMS)[18]
  - Cranial nerve testing
  - Tandem gait
  - Undilated fundoscopic exam
    - Abnormal eye or vision exams may require immediate referral to ophthalmology
- A suspected diagnoses of concussion can include one or more of the following clinical domains:
  - Physical symptoms – (e.g., headache, dizziness, light/noise sensitivity, nausea)
  - Physical signs (e.g., loss of consciousness, amnesia, neurological deficit, balance impairment, nystagmus, convergence insufficiency)
  - Behavioral changes (e.g., irritability, more emotional, anxiety, depression)
  - Cognitive impairment (e.g., slowed reaction times, mentally foggy, memory impairment/attention)
  - Sleep/wake disturbance (e.g., difficulty with sleep initiation or sleep maintenance)
- If any one or more of these components is present, a concussion should be suspected, and the appropriate management strategy instituted.

Clinical Management:

- **Exam positive for focal neurological findings**
  - Send to ED for emergent non-contrasted imaging of the head &/or neck, and consider consults with neurology or neurosurgery if positive imaging findings
  - Patient should be managed off the pathway, unless imaging negative and still suspected as having a concussion.
- **Discharge**
  - Patients with a concussion diagnosis can be discharged with the following instructions: [12, 9]

- Rest both physically & cognitively for 1-2 days, which includes keeping child out of school.
- Light activity is allowed
  - Recommending strict rest offers no benefit in adolescents. Restricting activity may in fact increase symptom reporting in this population. [3]
  - Avoid "cocooning" patient. While physical and mental rest is recommended, solitary confinement environments should be avoided.
- Limit/decrease use of electronic devices (do not eliminate use)for two days
- Sleep is encouraged
- Acetaminophen as needed
  - Pharmacological therapy should only be considered by clinicians with specialized training and experience in treating concussions
  - Manage specific and/or prolonged symptoms (e.g., sleep disturbance, anxiety, etc.)
  - Modify the underlying pathophysiology of the condition with the aim of shortening symptoms of concussion
- Ibuprofen/NSAIDs may be used as long as there is no evidence of intracranial bleeding
- Caregiver(s) should follow-up with primary care physician (PCP) in clinic or by phone within 2 days
- Clinical condition rarely deteriorates in the days after a concussion. However, clinicians should reassess the need for imaging and other studies at each appointment based on symptom presentation
- Weekly follow up post-concussion is recommended either in clinic or by phone to monitor symptom progression.

- **Approximately 2 days after concussion, PCPs should consider:**
  - Allowing patient to return to school with academic accommodations as needed (e.g., shortened school day, breaks during day, delayed test taking)
  - Encouraging a light increase in mental & physical activity as tolerated (physical contact sports/activities are not allowed)
- **Approximately 2 weeks after concussion, PCP should consider:**
  - Asking the following questions. If patient answers "yes" to any of these, PCP should consider referral to Sports Medicine Physician and/or Physical Therapy (PT):
    - History of previous concussion?[4]
    - History of depression/anxiety?[4,10]
    - A diagnosed learning disability, ADD, or ADHD?[1,3]
    - Post-Concussion Symptoms Score (PCSS) > 40?[13,14]
    - Presence of true vertigo (BPPV)?
    - Positive VOMS?[2]
    - Positive convergency insufficiency or nystagmus?
  - Asking the following questions. If patient answers "yes" to any of these, PCP should consider referral to Sports Medicine Physician and/or Speech-Language Pathology (SLP):
    - Difficulty concentrating?
    - Slower processing speed?
    - Difficulty with reading and/or reading comprehension?

        - Difficulty "finding words?"
        - Difficulties with long- or short-term memory?
        - Difficulty following directions?
    - If no to all questions, continue previous activity levels and accommodations.
- **Approximately 2-4 weeks after concussion; PCPs should consider:**
    - Removing academic accommodations as symptoms resolve (symptoms may resolve much earlier than 4 weeks)
    - Establishing an appropriate return to play transition based on age, activity, athlete versus non-athlete availability of athletic trainers, etc.
        - 80-90% of adolescent patients diagnosed with concussion will be able to return to normal activities within 4 weeks if there is no additional trauma
    - It is acceptable for athletic trainers to clear patients to return to play after following protocol

Referral considerations include:

- All concussion patients should follow up with PCP or previous concussion management physician within 1 week at least by phone call and in clinic appointment as needed
- 10-20% of patients diagnosed with concussion may require a referral to a specialist if they are not well enough to return to normal activities within 3-4 weeks.
- Concussions resulting from a motor vehicle accident (MVA) or other mechanism (fall from great height, etc.), consult neurology and/or Physical Medicine & rehabilitation
- Concussions related to sports, recreation, or similar activities consult with or refer to Sports Medicine
- Positive imaging finding consult Neurosurgery
- Post-concussive symptoms that include balance deficits, dizziness, headaches, and inability to return to previous level of activity, consider referral to Sports Medicine and/or Physical Therapy.
- Post-concussive symptoms that include cognitive deficits related to memory loss, difficulty concentrating, slower processing speed and speech difficulties related to word-finding, consider referral to Sports Medicine and/or Speech-Language Pathology

Modifying Factors in Concussion Management:

- A range of pre-existing conditions may influence the investigation and management of concussion. In some cases, these conditions may predict the potential for prolonged or persistent symptoms[12]. Modifiers include:
    - **History of previous concussion**[4]
    - **History of anxiety** [4,10]
    - **Depression**[4,10]
    - Migraine headache
    - Attention Deficit Hyperactivity Disorder (ADHD)[1,3]
    - Learning disability[1,3]
    - Sleep disorders

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Concussion Investigations:

- Advanced neuroimaging, fluid biomarkers and genetic testing are important research tools, but require further validation to determine their ultimate clinical utility in evaluation of concussion.[12]

Rationale

1. **Safety**: Shall be improved by gradually returning patients to school and social activities (prior to contact sports) in a manner that does not result in significant exacerbation of symptoms.
2. **Quality:** Will be improved by utilizing consistent discharge instruction between providers.
3. **Cost:** Shall be reduced by restricting brain imaging to those cases where there is suspicion of intra-cerebral or structural lesion (e.g., skull fracture) exists.
4. **Delivery:** The concussion pathway will improve efficiency at first patient contact as it will contain links to the necessary assessment screening tools and patient discharge instructions.
5. **Engagement:** Is created and supported by the involvement of a multidisciplinary team in the development and maintenance of the pathway.
6. **Patient/Family Satisfaction**: Shall be improved by providing the highest quality care based on established guidelines and the latest evidence available in the literature.

Implementation Items

- Concussion Discharge order set
- Concussion Smart Set (Children's Physicians)
- Return to Play and Return to Learn teaching sheets

Metrics

1. Concussion discharge order set with instructions usage of at least 80%.
2. Maintain minimal number of concussion patients that have CT or MRI imaging obtained. Maintain minimal referrals to neurology for concussion as the goal is to use the pathway to treatment them close to the PCP level.

Supporting Documents

- Glasgow Coma Scale
- Graded Symptom Checklist – 13 and Older
- Graded Symptom Checklist – 12 and Younger Patient Report
- Graded Symptom Checklist – 12 and Younger Parent Report
- Concussion Algorithm
- Sport Concussion Assessment Tool -6th Edition (SCAT6)
- Child Sport Concussion Assessment Tool (Child SCAT6) – for children ages 8-12 years
- Sport Concussion Office Assessment Tool (SCOAT 6) – for children ages 13+ years
- Sport Concussion Office Assessment Tool (Child SCOAT6) – for children ages 8-12 years

Team Members

SUSPECTED CONCUSSION

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Physician Owner: Dr. Kody Moffatt

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Appendix A

GLASGOW COMA SCALE		
Behavior	Response	Score
Eye Opening Response	Spontaneously To speech To pain No response	4 3 2 1
Best Verbal Response	Oriented to time, place & person Confused Inappropriate words Incomprehensible sounds No response	5 4 3 2 1
Best Motor Response	Obeys commands Moves to localized pain Flexion withdrawal from pain Abnormal flexion (decorticate) Abnormal extension (decerebrate) No response	6 5 4 3 2 1
Total Score:	Best response Comatose patient Totally unresponsive	15 8 or less 3

Appendix B
Graded Symptom Checklist – 13 and Older[5]

How do you feel?
"You should score yourself on the following symptoms based on how you feel right now."

	None	Mild		Moderate		Severe	
Headaches	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
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
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
Sleep disturbance	0	1	2	3	4	5	6
Abnormal heart rate	0	1	2	3	4	5	6
Excessive sweating	0	1	2	3	4	5	6
Other:_____							
Do symptoms worsen with physical activity?	Yes				No		
Do the symptoms worsen with cognitive (thinking) activity?	Yes				No		
Symptoms number							
Symptom severity score							
What percentage of normal do you feel?							

Appendix B
Graded Symptom Checklist – 12 and Younger [14]

How do you feel?
"You should score yourself on the following symptoms based on how you feel right now."

	Never	Rarely	Sometimes	Often
I have headaches	0	1	2	3
I feel dizzy	0	1	2	3
I feel like the room is spinning	0	1	2	3
I feel like I am going to faint	0	1	2	3
Things are blurry when I look at them	0	1	2	3
I see double	0	1	2	3
I feel sick to my stomach	0	1	2	3
I get tired a lot	0	1	2	3
I get tired easily	0	1	2	3
I have trouble paying attention	0	1	2	3
I get distracted easily	0	1	2	3
I have a hard time concentrating	0	1	2	3
I have problems remembering what people tell me	0	1	2	3
I have problems following directions	0	1	2	3
I daydream too much	0	1	2	3
I get confused	0	1	2	3
I forget things	0	1	2	3
I have problems finishing things	0	1	2	3
I have trouble figuring things out	0	1	2	3
It's hard for me to learn new things	0	1	2	3
My neck hurts	0	1	2	3
Do the symptoms get worse with physical activity?	Yes		No	
Do the symptoms get worse with trying to think?	Yes		No	

Appendix C

Graded Symptom Checklist – 12 and Younger Parent Report [14]

How do you feel?

"You should score your child on the following symptoms based on what you have observed most recently."

The child . . .	Never	Rarely	Sometimes	Often
has headaches	0	1	2	3
feels dizzy	0	1	2	3
has a feeling that the room is spinning	0	1	2	3
feels faint	0	1	2	3
has blurred vision	0	1	2	3
has double vision	0	1	2	3
experiences nausea	0	1	2	3
gets tired a lot	0	1	2	3
gets tired easily	0	1	2	3
has trouble sustaining attention	0	1	2	3
is distracted easily	0	1	2	3
has difficulty concentrating	0	1	2	3
has problems remembering what he/she is told	0	1	2	3
has difficulty following directions	0	1	2	3
tends to daydream	0	1	2	3
gets confused	0	1	2	3
is forgetful	0	1	2	3
has difficulty completing tasks	0	1	2	3
has poor problem-solving skills	0	1	2	3
has problem learning	0	1	2	3
has a sore neck	0	1	2	3
Do the symptoms get worse with physical activity?	Yes		No	
Do the symptoms get worse with trying to think?	Yes		No	