CONCUSSION
EVALUATION AND MANAGEMENT IN PEDIATRICS

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2.5 ANCC Contact Hours

Abstract

Concussions are among the most complex injuries to assess and manage in sports medicine and primary care. Sports concussion in youth has received much attention in recent years because research shows that improperly managed concussion can lead to long-term cognitive deficits and mental health problems. There are several notable risk factors affecting the incidence and severity of concussion in school-age children and adolescents, including a history of a previous concussion. A more conservative approach for return to activities following concussion has been proposed for children and adolescents. Programs of individualized, stepwise increases in physical activity have largely replaced use of algorithms for assigning a grade and activity expectations to concussions. Although validity and reliability testing is ongoing to support use of concussion assessment instruments in pediatric patients, it is practical and appropriate that clinicians incorporate symptom checklists, sideline and balance assessment tools, and neurocognitive assessment instruments into their practice in accordance with evidence-based guidelines.

Key words: Athletic injuries; Brain; Brain injuries; Concussion; Neurologic examination; Pediatrics.

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Concussions are considered to be among the most complex injuries in sports medicine and primary care to diagnose, assess, and manage. A concussion is a traumatic injury to the brain, generally characterized by rapid onset of a constellation of symptoms or cognitive impairments (Kutcher, Giza, & Alessi, 2010). The 4th International Conference on Concussion in Sport recognizes concussion as a subset of traumatic brain injury (McCrory, 2013).

Concussion is a biomechanically induced alteration in the function of the brain, rather than a structural or anatomic injury. Concussions are often the result of low-velocity injuries with symptoms that are not associated with pathologic structural injury. Loss of consciousness occurs in less than 10% of concussions (Scorza, Raleigh, & O'Connor, 2012). A concussion can be caused by a blow to the head, or a blow to the neck or other body part with a force that transmits to the head, resulting in rapid movement or rotation of the brain (Halstead & Walter, 2010).

Sports concussion in youth has received much attention in recent years because research shows that improperly managed concussion can lead to long-term cognitive deficits and mental health problems, and even contribute to death. The American Academy of Neurology acknowledges that variability in provider experience and training, coupled with an explosion of concussion-related literature, has led to uncertainty and inconsistency in diagnosis and management of these injuries (Giza et al., 2013).

The main purpose of this article is to provide an update on the most current pediatric standards and guidelines in concussion evaluation and management. This information will promote evidence-based practice standards that are consistent with "Return to Play" legislation that has been adopted by most states. Knowledgeable nurses can educate patients, parents, the public, and other providers on risks and prevention strategies for concussion, as well as approaches for detection and promotion of best outcomes following this common brain injury.

There is uniform consensus among major organizations that a child or adolescent should not be allowed to participate in sports while symptomatic from concussion.

Incidence, Prevalence, and Cost to Society

Though it is now improving, the public's knowledge of concussion has varied widely, resulting in gross underreporting of this common brain injury (McKinlay, Bishop, & McLellan, 2011). It has been estimated that up to 3.8 million sports and recreation-related concussions occur yearly in the United States (Langlois, Rutland-Brown, & Wald, 2006). Approximately 1 in 10 high school sports injuries is a concussion (Halstead, 2010). The difficulty in obtaining a better estimate of this number relates to underreporting, which occurs for several reasons. Without loss of consciousness, medical evaluation may not be sought following a concussion-inducing injury. Other times, care may be sought in a setting that does not use an injury surveillance system. An athlete may be reluctant to report head injury or seek medical attention for fear of being removed from his sport (Halstead, 2010; McCrea, Hammeke, Olsen, Leo, & Guskiewicz, 2004).

Finally, accurate concussion estimates may be hampered by the use of incorrect International Classification of Diseases codes (West & Marion, 2014).

The cost of concussion to society is even more elusive, as it is difficult to differentiate between costs for functional and structural brain injuries. In 2010, the Centers for Disease Control and Prevention (CDC) estimated that the cost of traumatic brain injury in the United States was approximately $76.5 billion, including both direct and indirect costs (Faul, Xu, Wald, Coronado, & Dellinger, 2010). Direct costs include expenses incurred for neurologic evaluation, management, and follow up. Persisting symptoms and long-term sequelae impose significant burden to individuals, families, and society, and produce enormous indirect costs related to lost or impaired productivity, school and work absence, and altered interpersonal relationships (Faul et al, 2010).

Consensus Statements and Standardization of Care

Many new or updated clinical practice guidelines and position statements have been recently published by stakeholder organizations to address growing interest in concussion identification and management. These guidelines have been compared and contrasted to identify points of agreement and opportunities for further clarification. A 2013 comparison of guidelines from the American Society for Sports Medicine, the American Academy of Neurology, and the Zurich Consensus Working Group (West & Marion, 2014) revealed important similarities. Among these points of agreement are the following:

- Concussion is a clinical diagnosis to be made by a licensed healthcare professional who is familiar with the signs and symptoms of this injury.
- There is no single test that can be used to determine whether a concussion has occurred.
- Computerized tomography (CT) scans of the head are not routinely recommended and should be reserved for cases where intracranial hemorrhage is suspected.
- Graded symptom and clinical sign checklists can be useful in diagnosing concussion and monitoring for resolution. This is especially true for athletes in whom a preseason checklist is available for comparison with postinjury results.
- A general, stepwise increase in physical activity, followed by increase in sports-related activity, is recommended prior to return to full play. Medications, such as analgesics, that mask clinical symptoms, should not be used while advancing activities.

It is important to pediatric providers that there is uniform consensus among major organizations that a child or adolescent should not be allowed to participate in sports while symptomatic from concussion, or on the same day that a concussion has occurred, regardless of duration of symptoms. The key recommendations require that a pediatric patient with suspected concussion not be allowed to return to full play until evaluation and clearance by a licensed healthcare provider. A more conservative approach for return to activities has been proposed for children and adolescents, as compared to adults. Programs of individualized, stepwise increases in physical activity have largely replaced algorithms for assigning a grade and activity expectations to concussions (Gomez & Hergenroeder, 2013).

In 2013, the Guideline Development Subcommittee of the American Academy of Neurology reviewed evidence from 1955 to 2012 to revise its position statement on concussion management in sports (Giza et al., 2013). Although specific interventions to improve outcomes were not identified, the subcommittee's practice recommendations specific to children and adolescents included the following:

- Individuals supervising student athletes should prohibit a student with a concussive-like injury from returning to practice/play until a licensed healthcare provider has determined that the concussion has resolved and that the student is asymptomatic without medication.
- Concussive injuries in children and adolescents should be managed more conservatively than in adults.
- Licensed healthcare providers can help in developing individualized graded plans to return to physical and cognitive activity, guided by a carefully monitored, clinically based approach to minimize exacerbation of symptoms.

There has been a national response to the impact of concussion on youth. As of 2014, all 50 states and the District of Columbia have enacted some type of legislation to address traumatic brain injury. For the majority of states, there has been enactment of "Return to Play" legislation to prevent concussion and limit injury to students or student athletes (State Laws on Traumatic Brain Injury, 2014). In general, these laws required school districts to develop programs to affect education of parents, coaches and administrators about concussion, removal of students suspected of having a concussion from sports participation, and clearance of students with concussion to return to play by a licensed healthcare professional who is qualified to assess fitness for play.

Currently, although most states have "Return to Play" legislation, not all of these states require healthcare professionals to receive specific training in concussion management, although there is movement in this direction. Many providers still rely upon reputable published resources to guide their practice. For example, the CDC (2014) has developed a Web site of concussion resources for students, athletes, parents, coaches, and healthcare professionals.

Risk Factors for Developing Concussion

History of a previous concussion has been established as one of the most significant risk factors for subsequent concussion (Covassin & Elbin, 2010; West & Marion, 2014). There are several other notable risk factors affecting incidence and severity of concussion in school-age children and adolescents. These risk factors can be broadly understood in terms of sport, age, sex, and special population groups.

Sport

Athletes who participate in contact or collision sports are at great risk for concussion. This risk is highest during competition (Boden, Breit, Beachler, Williams, & Mueller, 2013; Scorza et al., 2012). The American Academy of Neurology reports sports commonly associated with concussion include football, soccer, lacrosse, and basketball. Nontraditional sports that also pose risk for concussion include sledding, skateboarding, and motor cross (Giza et al., 2013).

Age

Adolescents from age 10 to 19 are more vulnerable to head injuries compared to younger children. Cognitive recovery from sports-related concussion in this age group also seems to require a longer period than that required of college or professional athletes (Ma et al., 2012).

Sex

Sex difference as a risk factor for concussion is controversial (Grady, 2010; West & Marion, 2014). Males have a higher overall incidence of concussion relative to their higher rates of participation in contact sports. Females, however, have almost a two-fold susceptibility to concussion in any sport where the rules of play are similar among males and females (Covassin, Elbin, Kontos, & Larson, 2010). Females seem to be more prone to concussion following collision with playing surfaces or equipment, whereas males are more prone to concussion after player-to-player collision (Scorza et al., 2012).

Special Population Groups

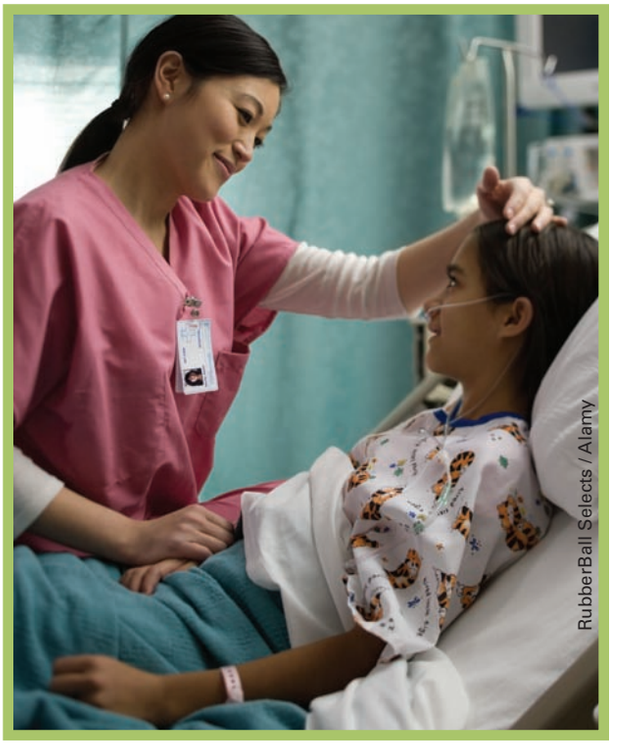
Students with attention-deficit and/or hyperactivity disorder, depression, or learning disabilities are at greater risk for concussion than those without these conditions (Grady, 2010). Student athletes with an increased body mass index seem to be at increased risk (Giza et al., 2013).

Suspected Concussion

At present there is no single tool or test to rely on for diagnosis of concussion. Concussion is a clinical diagnosis (McCrory et al., 2013). Because healthcare professionals are infrequently available to perform immediate assessment at the exact time of head injury, clinicians who practice in outpatient settings may be evaluating children and adolescents for concussion shortly after an injury for evaluation, in follow-up several days after primary evaluation in an emergency department, or when the athlete seeks help for persisting symptoms following an injury that was not yet evaluated.

Initial Evaluation: History and Physical Examination

Initial evaluation after a direct or indirect blow to the head involves ruling out cervical spine injury and serious traumatic brain injury, and addressing other urgent first-aid issues. After ruling out injuries that require immediate intervention, the next step in the assessment of a possible concussion is obtaining a complete history.



It is never appropriate for a child or adolescent with concussion to return to play on the same day as a concussive injury, even with symptom resolution.

This history includes a description of events leading up to the injury, location of any forcible impact to the body, whether there was loss of consciousness, and completion of a symptom checklist (Guskiewicz & Broglio, 2011). Loss of consciousness occurs in less than 10% of concussions (Scorza et al., 2012). The physical examination should include a thorough assessment of mental status, gait, and balance. Accordingly, recommendations for use of the Sport Concussion Assessment Tool 3 (SCAT 3) or another appropriate sideline assessment tool were made at the Zurich Conference (Guskiewicz et al., 2013; McCrory et al., 2013). Sideline assessment tools generally incorporate these important points, and can be administered by nonmedical trained providers (Table 1).

Assessment Tools

There are dozens of concussion management and assessment tools available today. Generally, these tools are identified as either concussion assessment tools or concussion management tools, and can be further categorized as symptom checklists, sideline assessment tools, balance assessment tools, or computerized neurocognitive examinations (Dziemianowicz et al., 2012). An example of a sideline assessment instrument can be found in Supplemental Digital Content, Figure 1, http://links.lww.com/MCN/A18.

TABLE 1: Instruments Commonly Used in Concussion Assessment and Management

Instrument	Category	Considerations
ImPACT[1]	Assessment and Management Tool Symptom Checklist	~20-minute assessment Tests memory, performance, reaction time, and speed of cognitive processing, and other areas of neurocognitive function Online version available
PCS[2] Post-Concussion Symptom Scale	Assessment and Management Tool Symptom Checklist	Originally developed to provide information to athletes, physicians, and athletic trainers on the resolution of concussive symptoms 22-item scale Subjective rating of 0–6 for each item
SCAT3[3] Sport Concussion Assessment Tool, 3rd Edition	Assessment Tool Sideline Assessment Tool	One of the most widely used tools for sideline injury assessment Test battery consisting of initial injury assessment with Glasgow Coma Scale, followed by observation/documentation of concussive signs, followed by symptom endorsement and rating of severity
ChildSCAT3[4]	Assessment Tool Sideline Assessment Tool	Standardized tool specific for assessing children aged 5–12 years of age
ACE[5] Acute Concussion Evaluation	Assessment and Management Tool Sideline Assessment Tool	Recommended for use by the Centers for Disease Control and Prevention as part of the "Heads Up" campaign to enhance evidence-based concussion management Includes injury characteristic assessment, symptom checklist, and screening for high-risk factors
SAC[6] Standardized Assessment of Concussion	Assessment Tool Sideline Assessment Tool	~5–7-minute assessment Designed to assess acute impairment by nonclinicians Component of SCAT Measures orientation, memory, concentration, and recall
BESS[7] The Balance Error Scoring System	Balance Assessment Tool	~3–5-minute assessment Postural stability assessed using three different stances, completed on both hard and soft surface Component of SCAT Assessment invalidated by ankle/leg injury
CRI[8] HeadMinder Concussion Resolution Index	Management Tool Internet-Based Neurocognitive Assessment Tool	Widely accepted telemedicine tool ~30-minute assessment Objective measures of reaction time, visual recognition, and speed of information processing

[1] Elbin, Schatz, & Covassin (2011) and Iverson, Lovell, & Collins (2005) [2] Lau et al. (2011), Lovell & Collins (1998), and Lovell et al. (2006) [3] Guskiewicz et al. (2013) [4] King, Brughelli, Hume, & Gissane (2014) [5] Cohen, Gioia, Atabaki, &Teach (2009) and Gioia, Collins, & Isquith (2008) [6] McCrea et al. (2003) [7] McCrea et al. (1998) [8] Erlanger et al. (2003)

Use of neurocognitive assessment tools in conjunction with symptom checklists has been shown to improve sensitivity, specificity, and both positive and negative predictive value of estimating protracted recovery when compared to using any instrument alone (Lau, Collins, & Lovell, 2011). Despite these recommendations and findings, no tools have been developed specifically for sideline assessment of children, and no currently available instrument has been validated for sideline use through all stages of a child's recovery (Davis & Purcell, 2014). Moreover, there is insufficient evidence to support appraisals developed using neuropsychological assessment tools in preadolescent groups. Although validity and reliability testing is ongoing to support use of adult instruments in pediatric patients, it is practical and appropriate that clinicians incorporate these instruments into their practice in accordance with local guidelines.

Imaging

Concussions cannot be diagnosed by a CT scan or magnetic resonance imaging (MRI), nor can they be ruled out by a negative CT scan or MRI. Imaging contributes little to the management of concussion other than ruling out serious traumatic brain injuries (e.g., intracranial hemorrhage, subdural or epidural hematomas), contusions, skull fracture, or cervical spine injuries (Scorza et al., 2012). There are guidelines available to clinicians to help guide these types of decisions. For example, a 2010 clinical report on sports-related concussion in children and adolescents from the American Academy of Pediatrics recommends that children who present with loss of consciousness greater than 30 seconds, evidence of skull fracture, or focal neurological or ophthalmologic findings following head injury be considered for imaging (Halstead & Walter, 2010).

Management of the Child with Concussion

Evidence is currently lacking to show that any specific intervention enhances recovery or diminishes long-term sequelae postconcussion (Giza et al., 2013; Grady, Master, & Gioia, 2012). Until more evidence emerges, cognitive and physical rest are cornerstones in concussion management of pediatric patients. Concern about long-term injury to the child's developing brain merits a more conservative approach than for adults.

Greater than 80% of concussions in children resolve with conservative management in the first 3 weeks postinjury (Collins et al., 2003). To achieve cognitive and physical rest during this period, demands on the child or adolescent must be reduced. Recommendations should be made for increased rest or sleep, time off from school or work, limitation of homework, minimal use of visually stimulating electronic activities, no unnecessary travel, and restriction of exercise and athletics. For older teens, driving should be prohibited pending medical clearance (Moser, Glatts, & Schatz, 2012; Moser & Schatz, 2012; Schneider et al., 2013). Best practice includes a multidisciplinary team that actively involves the student, family, medical providers, and relevant school and sports staff (McAvoy, 2009, 2012).

Concussion management is individualized and is dependent upon multiple factors including sign/symptom presentation; previous history of concussion; neurocognitive assessment; and parent, coach, and teacher report.

Specific recommendations to achieve cognitive and physical rest must be individualized and targeted to achieve optimal compliance. For example, if a child or adolescent finds television viewing to be relaxing and it does not exacerbate symptoms, it may be permitted in limited quantity, with modifications to reduce light and noise. There are currently no known interventions to speed recovery postconcussion in pediatric patients. Low levels of physical activity are being examined for benefit of those individuals who are slower to recover (McCrory et al., 2013).

Return to Play

A gradual return-to-play protocol can be implemented once a child or adolescent has recovered from the concussion injury across physical, cognitive, emotional, and sleep domains. The decision to return to play should never be made by one individual, or by using one assessment tool; rather, multiple data points from multiple sources should be considered. During graduated return-to-play activities, the student should not be taking medications that may mask the symptoms of concussion. A sample return-to-play protocol can be found in Figure 2.

Athletes between the ages of 10 and 18 years appear to be more symptomatic after concussion, and may take longer than adults to become asymptomatic (McAvoy, 2009, 2012). Evidence suggests that postconcussion headache persisting 7 days after injury in high school athletes is associated with incomplete recovery from concussion (Collins et al., 2003). If symptoms are increasing at any point, not improving by 2 weeks, or persisting beyond 3 weeks, a multidisciplinary rehabilitation strategy may be warranted, including referral to a specialized concussion management team (Makdissi, Cantu, Johnston, McCrory, & Meeuwisse, 2013).

Second Impact Syndrome

If a child or adolescent returns to full activities and/or sports before full resolution of concussion, the brain may be more susceptible to reinjury from a repeated injury. This rare condition is called "second impact syndrome" and its devastating consequences have been reported almost exclusively in teens (Boden, Tacchetti, Cantu, Knowles, & Mueller, 2007; McCrea, Perrine, Niogi, & Hartl, 2013; Weinstein, Turner, Kuzma, & Feuer, 2013).

Until more is known about the increased vulnerability to injury following concussion, it is widely accepted that children and adolescents not be permitted to return to full play while still symptomatic.

"Return to Learn"

Problems in the classroom setting have also been reported following concussion and are related to the signs and symptoms associated with this injury (Table 2). Paralleling gradual return-to-play recommendations, gradual return to cognitive exertion may be necessary to reduce symptoms during recovery. Following concussion, students have been found to have cognitive deficits, such as difficulty remembering previously learned material and difficulty learning new material. These students may benefit from individualized accommodations developed by a multidisciplinary team (Halstead et al., 2013).

Several terms should be familiar to the healthcare provider when requesting assistance from the school following concussion in a student (Halstead et al., 2013). These include **academic adjustments** (nonformalized adjustments to the student environment during a short [up to 3 weeks] recovery period and should not significantly alter curriculum requirements), **academic accommodations** (more formalized adjustments, in the form of a 504 plan for symptoms lasting beyond 3 weeks; may include schedule adjustments and testing rearrangements), and **academic modifications** (prolonged and more permanent changes to the curriculum that are usually in the form of an Individualized Education Plan).

Proactive Management: Concussion Counseling

In their 2013 guideline updates, the American Academy of Neurology recommends processes to support preparticipation concussion counseling for student athletes (Giza et al., 2013). It is recommended that healthcare providers educate designated school-based professionals so that they can provide accurate concussion information to parents and athletes, and healthcare providers inform athletes and their families of concussion risk factors.

For pediatric patients, the majority of concussions that bring children to an emergency department do not occur during competitive athletics, but rather are related to falls, bicycle and motor vehicle accidents, and other mechanisms (Meehan & Mannix, 2010). Anticipatory guidance about

FIGURE 2. Return-to-Play Protocol

STAGE	ACTIVITY	FUNCTIONAL EXERCISE AT EACH STAGE OF REHABILITATION	OBJECTIVE OF STAGE
1	**No activity**	Symptom-limited physical and congnitive rest.	Recovery
	When 100% symptom free for 24 hours proceed to Stage 2. (Recommend longer symtom-free periods at each stage for ounger student/athletes) ▼		
2	**Light aerobic exercise**	Walking, swimming, or stationary cycling keeping intensity <70% maximum permitted heart rate. No resistance training.	Increase heart rate
	If symptoms reemerge with this level of exertion, then return to the previous stage. If the student remains symptom free for 24 hours after this level of exertion, then proceed to the next stage. ▼		
3	**Sport-specific exercise**	Skating drills in ice hockey, running drills in soccer. No head-impact activities.	Add movement
	If symptoms reemerge with this level of exertion, then return to the previous stage. If the student remains symptom free for 24 hours after this level of exertion, then proceed to the next stage. ▼		
4	**Noncontact training drills**	Progression to more complex training drills, for example, passing drills in football and ice hockey May start progressive resistance training.	Exercise, coordination, and congnitive load
	If symptoms reemerge with this level of exertion, then return to the previous stage. If the student remains symptom free for 24 hours after this level of exertion, then proceed to the next stage. ▼		
5	**Full-contact practice**	Following medical clearance, participate in normal training activities.	Restore confidence and assess functional skills by coaching staff
	If symptoms reemerge with this level of exertion, then return to the previous stage. If the student remains symptom free for 24 hours after this level of exertion, then proceed to the next stage. ▼		
6	**Return to play**	Normal game play.	No restrictions

A graduated return-to-play approach has been recommended for children and adolescents following concussion (McAvoy, 2009). This sample instrument for guiding return-to-play progression is available online (www.dissingerreed.com/pdfs/REAP%20Concussion%20Management.pdf) and based upon recommendations by the 2012 Zurich Consensus Statement on Concussion in Sport (McCrory et al., 2013).

Figure 1 is provided as Supplemental Digital Content http://links.lww.com/MCN/A18.

TABLE 2: Concussion Symptoms, Signs, and School Considerations

Symptoms	Associated Signs	School Considerations
Headache; head pressure	Appears dazed, distant, or with behavioral evidence of pain	Need for analgesic medication Addition of quiet rest periods to schedule
Nausea	Vomiting Weight loss	Dietary adjustments Need for antiemetic medication
Balance difficulties Dizziness; lightheadedness	Clumsy movement Tripping	Provision of extra time to move from class to class
Visual problems: blurry vision, double vision, photophobia, phosphenes	Squinting Light avoidance Reduced use of video	Adjustments in use of computers, televisions, handheld devices Reduced room lighting Adjusted desk position in classroom
Noise sensitivity	Avoids headphones/ earphones Avoids crowds Reduced use of audio	Alternatives to lunchroom and noisy classrooms/hallways/ activities
Concentration difficulties Confusion feeling "foggy"	Delayed response to questions Unfocused in classroom Impaired school performance	Adjustment of academic expectations Accommodations for test taking/standardized testing Shorter instruction periods Consideration of supplemental tutoring
Memory difficulties	Inability to recall events Difficulty learning new concepts Slower processing Impaired school performance	Adjustment of academic expectations Provision of prepared class notes or use of a peer scribe Work toward comprehension of gradually increasing amounts of material
Sleep disturbance Fatigue	Sleeping more/less than usual Daytime/classroom napping School lateness	Adjustment of school schedule to include strategic rest periods "Quiet reading" may not be restful for some students Consideration of supplemental tutoring
Change in mood Depression Anxiety	Irritability Behavior/personality changes Difficulty with friendships	Possible psychologist/social worker referral Peer education to enhance support

concussion is relevant to all children and their parents. This information should be reasonably included as part of well-child counseling. Because prior concussion is a significant risk factor for future injury as well as a risk factor for neurocognitive impairment, ascertaining concussion history can also be made a part of the annual visit. For children and adolescents who report events suggestive of an interim concussion, but who may not have been formally evaluated at the time of injury, neuropsychological testing should be considered in cases where residual effects are suspected. For children and adolescents who have a history of multiple concussions, formal neurocognitive testing may help guide decisions for withdrawal from competitive sports (Giza et al., 2013). Sports preparticipation baseline neuropsychological testing has not shown substantial utility in helping to diagnose postinjury concussion (Echemendia et al., 2012), but the American Academy of Neurology emphasizes that such tests are only an adjunct in the evaluation of head

TABLE 3: Web Resources for Clinicians

Organization and Web Address	Comments
Centers for Disease Control and Prevention (CDC): Injury Prevention and Control/Traumatic Brain Injury www.cdc.gov/concussion	Reference to learn more about all aspects of concussion. Access to *ACE* assessment instrument and *Heads Up to Concussion* clinician training materials.
National Conference of State Legislatures (NCSL): Traumatic Brain Injury Legislation www.ncsl.org/research/military-and-veterans-affairs/traumatic-brain-injury-legislation.aspx	Comprehensive compilation of state legislation related to traumatic brain injury, return-to-play legislation, and family/coach education requirements.
Institute of Medicine (IOM): Sports-Related Concussion in Youth www.iom.edu/concussions	Access to the IOM full text report, "*Sports-Related Concussion in Youth: Improving the Science, Changing the Culture.*"
Brain Injury Association of New York State www.bianys.org	Information, resources, and advocacy information for brain injury survivors, family members, professionals, and educators. Access to the 20-page clinician guide "*REAP: The Benefits of Good Concussion Management*"
American Association of Rehabilitation Nurses (ARN) http://www.rehabnurse.org/uploads/files/cpgmtbi.pdf	Access to the clinical practice guidelines series, "*Care of the Patient with Mild Traumatic Brain Injury*" developed by the American Association of Neuroscience Nurses and the Association of Rehabilitation Nurses

Concern about long-term injury to the child's developing brain merits a more conservative approach to concussion than is taken in adults.

injury, and cannot be used alone to diagnose concussion (Giza et al., 2013).

Clinical Implications

Incidence and impact of concussion are of increasing concern to the healthcare, athletic, and educational communities. Guidelines for assessment and management of children and adolescents who have sustained a concussive injury support the following: concussion severity should be determined by the degree of functional impairment and/or the duration of symptoms rather than by the mechanism of injury; concussion management should be individualized and is dependent upon multiple factors including sign/symptom presentation, previous history of concussion, neurocognitive assessment, and reports from parents, coaches, and teachers; concussion management should be driven by concern for long-term cognitive impairment; and concussive injuries in children and adolescents should be managed more conservatively than in adults.

Systems are needed to improve early detection of this brain injury and tracking of symptoms from time of diagnosis. For children and adolescents, an active plan of cognitive and physical rest pending neuropsychological recovery and symptom resolution is the mainstay of treatment, followed by a graded program of exertion prior to medical clearance for return to full activities. Student athletes should never return to play on the same day as a suspected concussion, regardless of symptoms. Current evidence for concussion management in pediatrics is based mostly upon consensus and usual practice. Rigorous evidence for clinical recommendations for children and adolescents is greatly needed. Web resources for clinicians are listed in Table 3. ✣

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