

DECISIONS

A 15-year-old rugby player with a head injury

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During a rugby tournament, a 15-year-old girl was tackled and her head struck her opponent's knee. She was slow to get up, and appeared unsteady and dazed. After using the Pocket Concussion Recognition Tool¹ to assess the player's condition, her coach suspected that she had a concussion and removed her from the game. Her symptoms began to improve over the next few hours, and she was brought to her family doctor the same day for evaluation, with reports of mild headache, difficulty concentrating and feeling "foggy," all worsened by loud noises and bright lights.

What should be included on history-taking and physical examination?

There are tools available to help clinicians assess athletes with possible concussion. The Sport Concussion Assessment Tool, 3rd edition (SCAT3) can be used for athletes 13 years of age or older, and a children's version exists for those aged 5 to 12 years.^{1,2} SCAT3 requires about 15 minutes to complete and includes the following items: Glasgow Coma Scale; modified Maddocks questions (a memory assessment); review of subjective symptoms; Standardized Assessment of Concussion (a cognitive assessment); and examination of the neck, balance and coordination; as well as background information and mechanism of injury.² Although SCAT3 was recently published in 2013 and has not been formally assessed for reliability and validity in large studies, the Standardized Assessment of Concussion element of SCAT3 has been studied with a sensitivity of 80%–94% and a specificity of 76%–91%.³

Does the patient require computed tomography of her head?

Computed tomography (CT) of the head is appropriate in the acute setting when a clinically important intracranial injury, such as an epidural

or subdural hematoma, is suspected. Imaging is not required in minor head trauma if there are no red flags (Box 1).⁴⁻⁶

The Pediatric Emergency Care Applied Research Network (PECARN) prediction rule may help guide the decisions of health care providers about the need for CT.^{1,5} The prediction rule was derived from a large pediatric cohort with head injury ($n = 42\,412$) and is validated for children, with high sensitivity (100% age < 2 yr; 96.8% age \geq 2 yr) and negative predictive values (100% age < 2 yr; 99.95% age \geq 2 yr).⁵ Finally, head CT cannot be used to diagnose concussions because acute concussion symptoms are caused by functional disturbances rather than gross structural injury.²



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Box 1: Choosing Wisely Canada recommendation on imaging in minor head trauma*⁴⁻⁶

Don't do imaging for minor head trauma† in children \geq two years of age unless red flags are present

- Red flags in children include abnormal neurologic examination, abnormal mental status and suspected skull fracture (e.g., a large, boggy scalp hematoma, and for suspected basal skull fracture, hemotympanum, raccoon eyes, Battle sign and cerebral spinal fluid otorrhorrhea). Other relative indications for imaging include GCS score \leq 14 at two hours after injury, a "dangerous" mechanism of injury,‡ known coagulation disorder and worsening symptoms after an observation period of several hours in the emergency department.
- To protect against risks of radiation, an observation period of several hours should be considered before CT for those children with minor head trauma and any of the following:
 - History of loss of consciousness
 - Amnesia, confusion, lethargy or irritability
 - Repeated or persistent vomiting
 - Severe or persistent headache
 - Immediate posttraumatic seizure

CT = computed tomography, GCS = Glasgow Coma Scale.

*Adapted for use in children as per the Pediatric Emergency Care Applied Research Network prediction rule⁵ and the Canadian Paediatric Society recommendations on management of the pediatric patient with acute head trauma.⁶

†Defined as GCS score of 14–15. All patients with moderate (GCS score 9–13) or severe (GCS score \leq 8) head trauma should undergo cranial CT.

‡"Dangerous" mechanisms include falling from a height, motor vehicle collision in which speed was a factor, and impact with a projectile, such as gunshot or metal fragment.

What treatments should be offered to the patient?

The mainstay of concussion treatment is to prescribe both physical and cognitive rest, which includes an initial rest period of 24–48 hours. A single-centre prospective cohort study showed that increased cognitive activity was associated with longer recovery from concussion.⁷ Patients and parents/caregivers should monitor symptoms every 24 hours. Combined with clinical judgment, it is safe for this adolescent to be observed at home if the following conditions are met: normal mental status with improving symptoms; no risk factors indicating need for CT or normal CT if already done; and no indications for prolonged observation, such as worsening symptoms, bleeding disorders or multisystem injuries.¹

Box 2: Advice for patients with concussion and their families at the initial assessment¹

- Avoid high-speed and contact activities that may increase the patient's risk of sustaining another concussion, especially during the recovery period
- Manage sleep by maintaining the same bed and wake times every day throughout the year, by turning off all electronic devices at least 30 minutes before bed, and by limiting naps to in bed and once a day
- Manage headaches by beginning with nonsteroidal anti-inflammatory drugs and acetaminophen (recommended usage < 15 d/mo)
- Keep a diary to identify triggers for fatigue, and be aware that it may come on suddenly or without exertion
- Maintain social networks and interactions, because reducing the risk of mental health issues and social isolation may promote recovery
- Avoid alcohol and other recreational drugs to prevent self-medication and prolongation of recovery, and to prevent risky behaviour associated with impaired judgment
- Avoid driving during recovery, because this complex process requires cognition, attention, vision, balance, reaction time and judgment (all of which may be affected)
- Follow up with primary care physician regularly; if symptoms persist after one month, referral to specialized care may be initiated

Box 3: Summary of key steps for initial management of suspected concussion in children and adolescents¹

- Assess and treat any physical, cognitive and neurological deficits
- Determine the need for CT
- Consider hospital observation if the patient shows red-flag symptoms
- Prescribe physical and cognitive rest
- Discharge the patient for observation at home under certain conditions (i.e., satisfactory mental status, no abnormal CT scan, no indication for prolonged observation)
- Provide verbal information and written handouts to the patient and parents and/or caregivers
- Inform on the expected course of recovery and return to learning and play
- Advise on sequelae, sleep, headaches, fatigue, social activity, alcohol and drugs, driving and follow-up

CT = computed tomography.

What instructions should the patient and family receive at the end of the visit?

Families should be informed of the expected course of recovery and timelines for expected return to normal activities, including lifestyle strategies, expectations, anticipatory guidance, and verbal reassurance through both verbal information and written handouts.¹ Whereas most children fully recover within two weeks, some children may require months to recover.⁸ The Ontario Neurotrauma Foundation's guideline on concussion suggests information that physicians should discuss with patients and their families at the end of the visit (Box 2).¹

What follow-up should be arranged?

The patient should be followed weekly by phone or in person to monitor symptom progression using a validated symptom inventory (e.g., Post-Concussion Symptom Inventory for Children).¹ After the patient's acute symptoms have improved, a stepwise plan to return to normal activities (including school) should be developed. Although there is evidence from cohort studies supporting the need for physical and cognitive rest, there is still ambiguity as to the ideal duration of rest; therefore, the treating physician may choose a standard approach (e.g., the Acute Concussion Evaluation Post-Concussion Gradual Return to School tool) or a more conservative approach (e.g., CanChild Return to School Guidelines for Children and Youth).¹

When is it safe to allow the patient to return to sport?

A return-to-play program should be developed only after the teen has started her program for returning to normal activities (including school). Similar to cognitive rest, there is still ambiguity in the literature as to the ideal duration of physical rest.¹ The Parachute After a Concussion Guidelines for Return to Play tool reflects a standard approach, and the CanChild Return to Activity Guidelines for Children and Youth tool reflects a more conservative approach.¹

An adolescent who has sustained multiple concussions should be referred to an expert in pediatric sport concussion (e.g., sport medicine doctor, brain injury clinic, neurologist) to further assist with return-to-play decisions or retirement from contact sports. Box 3 summarizes key steps in the management of concussion from sports in children and teens.¹

The case revisited

The patient was assessed using the SCAT3 tool, which showed a Glasgow Coma Scale score of 15, a total of five symptoms with a severity score of 15,

cognitive assessment only significant for 1/5 on concentration, and unremarkable neck, balance and coordination examination. No head CT was ordered, because there were no worrisome signs or symptoms suggesting a more serious head injury according to the PECARN rule.¹ She was prescribed both physical and cognitive rest using conservative stepwise plans (CanChild Return to Activity and CanChild Return to School).¹ A template letter of accommodation was sent to her school outlining her plan.¹

The patient monitored her own progress every 24 hours and communicated the current status of her Post-Concussion Symptom Inventory weekly with her doctor.¹ By three weeks, her progression in her return-to-play plan permitted her to begin rugby drills with her team without contact. Four weeks after her concussion, she returned to full game play after being cleared by her family physician.

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Organizations that have endorsed the Ontario Neurotrauma Foundation's Guidelines for Diagnosing and Managing Pediatric Concussion: Brain Injury Association of Canada, Canadian Association of Emergency Physicians, Canadian Nurses Association, Canadian Physiotherapy Association, Parachute, Registered Nurses' Association of Ontario, Translating Emergency Knowledge for Kids.

Additional resources

The Ontario Neurotrauma Foundation's Guidelines for Diagnosing and Managing Pediatric Concussion, patient handouts and the clinical tools mentioned in this article are available at http://onf.org/system/attachments/265/original/GUIDELINES_for_Diagnosing_and_Managing_Pediatric_Concussion_Full_v1.1.pdf.

CMAJ is collaborating with Choosing Wisely Canada (www.choosingwiselycanada.org), with support from Health Canada, to publish a series of articles describing how to apply the Choosing Wisely Canada recommendations in clinical practice.