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Identifying and Managing Concussions

Section 1: Introduction

Concussions are a prevalent injury that affects millions of people each year. It is estimated that 1-3 million people visit the emergency room for concussion-related care in the United States annually (Cleveland Clinic, 2024). It is also estimated that 7 out of 10 visits to the emergency department due to sports and recreation-related injuries for children are due to traumatic brain injuries and concussions (CDC, 2026). Globally, it is estimated that 5.48 million people each year experience a traumatic brain injury, many of which are concussions (Ahmed et al., 2024). An accurate prevalence of concussion is difficult to determine, as it is estimated that only one in nine concussions is captured in clinical data (Khan, 2026).

Concussions can have serious short and long-term effects, so it is imperative that those who experience a concussion be closely followed by a health care provider (CDC, 2025b). Nurses may encounter individuals with traumatic brain injuries, including concussions, in many settings, so they must understand what a concussion is, be knowledgeable regarding different types of concussions and risk factors, be able to identify signs and symptoms of concussion, understand diagnosis and treatment, identify potential complications, and be able to communicate vital information regarding recovery to patients and their caregivers through education. While concussions are common, they are also commonly misunderstood (Cleveland Clinic, 2024), and nurses can support optimal outcomes by providing evidence-based education regarding this type of traumatic brain injury.

Section 1 Personal Reflection

Why is it difficult to accurately determine the prevalence of concussions? How can nurses support an optimal outcome after a patient has experienced a concussion?

Section 2: What is a Concussion?

Concussion, or the symptoms associated with this diagnosis, have been recognized for many centuries. There is a written record of the concept of concussion as early as the 4th century, when Hippocrates, known as the Father of Medicine, identified associations between head injuries and loss of consciousness. He also associated these with impairments in vision, hearing, and speech. In the 10th century, Rhazes, a Persian physician, determined that concussion was due to a transient physiologic alteration rather than structural brain injury. The term concussion began to be used during the Renaissance, though research on the mechanisms of concussion did not begin until the 17th and 18th centuries. At the time, it was suggested that microscopic injuries may have been involved (Khan, 2026).

In the early 20th century, the impact of traumatic brain injuries during World War I was studied in soldiers, confirming the presence of brain injury in the absence of visible injury. “Punch drunk syndrome” was also described in the early 20th century, when Dr. Harrison Martland identified an association between brain lesions and neurological symptoms in boxers, noting that boxers who experienced significant head trauma experienced similar neurological symptoms. Chronic traumatic encephalopathy (CTE) was identified by Dr. Abram Bowman and Dr. Karl Blau in 1940 while studying neurological disease in these athletes. Interestingly, British neurologist Dr. MacDonald Critchley noted that “punch drunk syndrome” was more prevalent in second and third-rate boxers than in championship-pedigree fighters, an early recognition that the quantity of repeated head injuries likely had an association with long-term neurological symptoms. In the 1940s and 1950s, researchers discovered more specific pathological causes behind concussion, and histopathological advancements in understanding persisted into the late 20th century (Eaton & Lonser, 2024).

Concussion injury and the long-term effects of repeated brain trauma became a focus of research in the early 21st century, especially related to sports injuries. In 2005, Dr. Bennett Omalu published the first known case of CTE in an NFL player, Michael Webster, and later documented another case in NFL player, Terry Long. Dr. Ann McKee conducted a large cohort study that summarized the histological features related to CTE. Findings in the first decade of the 21st century led to changes in sports to reduce concussions and the long-term impacts of these injuries. Further research has led to return-to-play guidelines and increased measures to reduce concussions in athletes and in other activities. Research continues to focus on refining return to play guidelines, the long-term impact of military-relevant brain injuries, and biomarkers that may indicate subclinical concussions (Eaton & Lonser, 2024).

A concussion is a type of traumatic brain injury that occurs when a force to the head or body occurs that causes the brain to move rapidly back and forth within the skull (CDC, 2025b). This may be due to a bump, blow, or jolt. When this sudden movement occurs, the brain can bounce or twist within the skull, resulting in chemical changes and mechanical damage. The mechanical damage associated with a concussion occurs when brain cells are stretched or otherwise injured. When this type of injury happens, individuals may experience cognitive changes (CDC, 2025b). While concussions are not typically life-threatening, they can last days, weeks, or even months. When a person experiences multiple concussions, their brain structure and function can be permanently damaged, leading to serious health complications (Cleveland Clinic,2024). Another term for concussion is a mild traumatic brain injury (mTBI). The most common causes of concussions include motor vehicle collisions, being struck by an object, assault, and sports-related head injuries (Ferry & DeCastro, 2023)

To better understand concussions, nurses must recall the structure and functions of the areas of the brain. The brain is composed of billions of neurons. The

cerebrum is divided into left and right hemispheres and further divided into four lobes. These four lobes are the frontal, temporal, parietal, and occipital lobes. In addition to the lobes are the central subcortical structures and the cerebellum. The cortical surface, also known as the gray matter, is found as a layer in the cortical, subcortical, and cerebellar areas. This is where the neuronal cell bodies, dendrites, glial cells, axons, and synapses exist and where neuronal signals are produced. White matter, located deeper beneath the cortex, contains myelinated and unmyelinated neuronal axons and is where connections between neuronal cell bodies transmit signals between regions of gray matter (Danielli et al., 2023). The cerebellum is located at the back of the head, just above and behind where the spinal cord connects to the brain. While the cerebellum accounts for only about 10% of the brain's physical size, it contains about half of all neurons in the body. It is very compact but affects many aspects of human functioning and cognition (Cleveland Clinic,2022).

Since more severe structural injuries are otherwise categorized, concussions are most often present when there is shearing or tearing of the white matter tracts. The gray matter contains different regions associated with various functions. For example, the amygdala is a region of gray matter associated with emotional and cognitive processing and is linked to the limbic system. This small, almond-shaped structure governs emotional responses to pain, fear, threats, rewards, empathy, self-concept, and facial expressions. It is important for social interactions, the interpretation of visual signals, and some types of memory and learning. When this structure is damaged, deficits can occur in these areas. Commonly reported post-concussive symptoms associated with the amygdala include headaches, brain fog, difficulty concentrating and remembering, irritability, depression, and sleep disturbances. Broca’s area, located in the frontal lobe, governs language processing and speech motor control. Damage to this area can lead to difficulty concentrating, remembering, and speech and language problems. Injury to the

hippocampus can cause memory challenges, emotional lability, sadness, and nervousness (Danielli et al., 2023).

Understanding the complex pathophysiology of concussion allows for more insight and understanding by the healthcare community and informs clinical recommendations for patients. This area of science continues to be explored as researchers work to understand concussions more thoroughly. When a sudden mechanical force is applied to the brain, several chemical signaling events occur simultaneously, known as acute neurometabolic cascades. This leads to neurological changes and the symptoms associated with a concussion, such as cognitive impairment and a change in mental status. Multiple acute neurometabolic cascades occur simultaneously. Cellular ionic homeostasis is disrupted, resulting in a sudden depolarization of the neurons, which is immediately followed by diffuse neuronal depression. Shearing and stretching forces on the plasma membrane of neurons cause an influx of sodium and calcium into the neurons, while simultaneously releasing potassium from the neurons. This event causes excitatory neurotransmitters to be released. Glutamate is a neurotransmitter that triggers the release of potassium and binds to N-methyl-D-aspartate (NMDA) receptors. This event creates a rapidly recurring feedback loop of depolarization and hyperexcitability. While this process is usually regulated in the healthy brain by the neurotransmitter GABA, brain injury disrupts the balance between glutamate and GABA, leading to neuronal dysfunction, damage, and cell death. Excess calcium in the cell damages the neuron through signaling cascades that lead to free radical production, elevated inflammatory marker concentrations, and hyperactivation of signaling pathways related to cell death. Astrocytes within the synaptic cleft are unable to regulate glutamate following injury to the neurons (Ahmed et al., 2024).

Excess, unregulated glutamate contributes to the development of concussion histopathology and symptoms. The processes that increase glutamate following

brain injury are complex and interconnected. Severe injury to neurons causes them to die, leading to a dramatic increase in extracellular glutamate concentrations as these dead cells leak. This process also contributes to neuroinflammation. Even when neurons are not immediately mortally injured, the shear stress forces that lead to the rapid depolarization loop cause synaptic glutamate release. A disruption in astroglial glutamate uptake contributes to an excess of extracellular glutamate. Sheer stress also leads to neuronal swelling and increased intracranial pressure. When there is a vascular injury due to the initial impact, disruption of the blood-brain barrier and exposure of neurons to blood cause ischemia, which triggers further glutamate release. Disruption of the blood-brain barrier also contributes to neuroinflammation by impairing glutamate uptake (Ahmed et al., 2024).

The different processes that lead to excess extracellular glutamate contribute to the spreading depolarization of the neurons, resulting in glutamate toxicity. Increased calcium in the cell damages the mitochondria, impairing the neuron's ability to restore homeostasis and depleting the cell of energy. This creates an energy crisis in the neurons that can last 5-10 days following injury. Inflammation and swelling reduce oxygen delivery to damaged tissues, leading to lactate production and an acidic environment. These factors create a state of overall brain hypometabolism (Ahmed et al., 2024), causing secondary brain injury, which results in cognitive dysfunction (Lai et al., 2022).

Brain injuries can also cause hormone disturbances, leading to endocrine and metabolic dysfunction. Endocrine function is regulated by the hypothalamic-pituitary axis, which can be disrupted following a traumatic brain injury. This specific disruption especially affects attention, memory, and executive function (Lai et al., 2022). Research suggests that hypometabolism following a brain injury, especially hypometabolism of glucose in the prefrontal cortex, is associated with chronic symptoms following concussion. Since the prefrontal cortex is vital to

cognitive processes like planning voluntary movements, attention, sensory processing, and goal-directed behavior, hypometabolism of glucose in this region contributes to cognitive impairment. Research is ongoing to determine whether this information can be used to predict outcomes and guide brain stimulation protocols following concussion (Pingue et al., 2025).

Section 2 Personal Reflection

How do you think early scientists made the connection between the cause and effect of concussion symptoms? How would you explain the pathophysiology of a concussion to someone? Why are the physiological effects following impact to the head cyclical?

Case Study

Asher is a 17-year-old athlete who experiences an injury to the head during a particularly severe tackle on the football field. He may have a concussion. How would you explain a concussion to Asher and his caregiver?

a. A concussion occurs when electrical misfiring occurs in the brain, causing seizures.

b. A concussion is caused when a significant impact to the head leads to chemical and physical changes in the brain.

c. A concussion is the same as a hematoma and occurs when there is a bruise on the scalp.

d. Concussions are injuries to the bones of the skull.

Section 3: Types of Concussions

In the past, a grading system was used for concussions. Symptoms and circumstances at the time of the injury were used to categorize concussions as Grade I-III, depending on these factors, with Grade I considered as mild and Grade III as severe. However, in recent years, research has found that categorizing concussions is more complex than originally thought. Current evidence-based practice emphasizes individualization of care for each patient and focuses on their specific symptoms and recovery. Since everyone experiences concussions differently, they are considered either present or not, without a specific grading system. The length of time for recovery and the patient's ability to return to activities provide a more accurate categorization of concussion. Still, this information cannot be obtained until the patient is fully recovered (St. Charles Healthcare, 2026).

Concussion is a heterogeneous disorder, meaning symptoms can vary by patient and injury. It is difficult to determine specific types of concussion. However, there are ways to categorize concussions, which may help the healthcare team have a better understanding of the length of time needed for recovery and resolution of symptoms. This may also help to predict potential long-term complications, such as the development of depression following a concussion. One study determined subtypes based on EEG findings following concussion. Statistical analysis of the studied EEG results identified five distinct subtypes, suggesting differences in the underlying pathophysiology of the injuries. Based on these findings, participants were assigned to subgroups. Some subtypes were associated with prolonged recovery, while others were associated with more rapid recovery. This information also revealed pathophysiological similarities within the subgroups. For example, those in one particular subgroup exhibited frontal connectivity abnormalities, increasing risk for depression. Another subgroup may be at increased risk for posttraumatic stress disorder due to injury to the hippocampus. This study did not

identify differences in the mechanism of injury or symptom distribution among the subgroups. This information may be useful in individualizing patient care plans and optimizing outcomes (Armañanzas et al., 2024).

Some have suggested categorizing concussions based on symptoms; however, this is challenging as symptoms can vary and overlap. Subtypes identified based on predominant ongoing symptoms include migraine, cognitive, oculomotor, vestibular, and mood (Khan, 2026). Researchers continue to explore differences in EEG features, symptoms, and recovery times to inform clinicians' recommendations regarding when patients can return to their usual activities (Armañanzas et al., 2024).

In the past, symptoms have been the primary identifier when attempting to categorize concussions into subtypes. The inclusion of EEG data can help scientists more specifically identify areas of underlying brain dysfunction. Understanding which subtype a patient belongs to can also help guide treatment, as research suggests one subtype may be more prone to depression while another may be at increased risk for post-traumatic stress disorder (Armañanzas et al., 2024).

Section 3 Personal Reflection

Why does the medical community no longer use a grading system for concussions? Why is it difficult to categorize concussions based on symptoms? How can an EEG provide information related to a specific type of concussion? How can identifying a concussion subtype help guide clinical care?

Case Study

Asher's caregiver wants to know what grade of concussion Asher has. What information should the healthcare team share with them?

a. Concussions are unique. Research has found that an individualized view of concussions is more beneficial, and the severity of a concussion may not indicate the time needed for recovery.

b. All concussions are considered Grade I concussions since they are mild traumatic brain injuries.

c. Concussions cannot be categorized in any manner.

d. Concussions are no longer categorized by grade but instead by the severity of the injury at the time of occurrence.

Asher's caregiver wants to know if this recovery will be similar to his recovery when he experienced a prior concussion. What can Asher's nurse tell his caregiver? Select all that apply.

a. Concussion recovery depends on many complex factors.

b. No two concussions are the same.

c. Previous concussion experiences can be used to predict recovery for subsequent concussions, as they are likely to be the same.

d. Concussion recovery following a second concussion is always quicker than the first concussion.

e. Recovery is based on the grade of concussion.

f. Some factors used to categorize concussions can help guide clinicians in recommendations for recovery and what a patient may need, but no specific predictions can be made regarding recovery.

Section 4: Risk Factors

While a concussion can occur in any person, some factors can increase an individual's risk. Age can influence risk for concussions. People who are older than age 65 or younger than age 4 are at increased risk for concussion due to their increased risk of falling (Cleveland Clinic,2024). For children over 1 year old, falls are more likely due to increased mobility, exploration, and independence, and typically occur when walking, climbing, running, or jumping. Though head injuries in infants most often occur as a result of an accident, abusive head trauma should always be considered in children less than 2 years old (Beauchamp et al., 2024). Adolescents are at increased risk, and this population experiences more concussions than any other age group. It is thought that this is likely due to their rapidly developing brains and bodies, which can affect coordination (Cleveland Clinic, 2024). Research has found that the adolescent brain is more susceptible to sustaining a concussion than adults, and it may take adolescents and young adults significantly longer to recover from a concussion (Ahmed et al., 2024).

Genetics can increase the risk of a concussion. Research has found that females are more susceptible to sustaining a concussion, and it has been hypothesized that some individuals may be at increased risk due to their particular genetic makeup (Ahmed et al., 2024). Female athletes are twice as likely to experience a concussion as male athletes playing the same sport (Ferry & DeCastro, 2023).

Athletes, especially those who play contact sports, are at significantly increased risk for concussions (Cleveland Clinic, 2024). The type of athletic activity can determine risk for experiencing a concussion. The sport associated with the most concussions is boys' tackle football, with 63% of those concussions occurring during a tackle. Girls' soccer is the next leading sport associated with concussion, followed by boys' lacrosse, boys' ice hockey, boys' wrestling, girls' lacrosse, girls' field hockey, girls' basketball, boys' soccer, and girls' softball. Most concussions

that occur during wrestling occur with ‘takedowns,’ and most concussions that occur in girls’ basketball are due to colliding with another athlete. Most sport-related concussions, in general, result from colliding with another athlete in some manner (CDC, 2026). Though sports-related concussions contribute to a small percentage of all concussions, the most current research is focused on this area (Ferry & DeCastro, 2023).

The risk of concussions and complications from concussions can be reduced in athletes when parents, coaches, and other players encourage players to report symptoms of a concussion. Players who must sit out due to a concussion should be supported. Increasing opportunities for non-contact football programs, limiting the number of contact practices in contact sports, enforcing safety rules, and ensuring athletes do not hit another athlete in the head or use their head to hit an athlete can help reduce the risk of concussions in sports (CDC, 2025d).

A person’s job can affect their risk for a concussion. Individuals with physically demanding jobs or who work with heavy equipment are at increased risk. This may include working on ladders, roofs, or other work tasks that involve a significantly increased risk of falls (CDC, 2025c).

Experiencing a concussion increases the risk of experiencing a subsequent concussion (Cleveland Clinic,2024). These individuals are also more likely to experience a concussion due to a lesser force of impact and likely require more time to recover (Ahmed et al., 2024).

Section 4 Personal Reflection

What are some risk factors associated with concussion? What factors related to specific age groups increase risk? Why are athletes at increased risk of experiencing a concussion? How could someone’s job increase their risk for a

concussion? Why do you think individuals who have experienced a previous concussion are at increased risk for experiencing another concussion?

Case Study

When interviewing Asher and his caregivers, the nurse learns that Asher has played tackle football for four years and has had a concussion before. He has good grades and works after school for his dad, who is a roofer.

What are the risk factors that increase Asher's likelihood of experiencing a concussion? Select all that apply.

a. Asher attends public school
b. Asher is an academic high achiever
c. Asher plays tackle football
d. Asher has had a previous concussion
e. Asher is male
f. Asher has a job that puts him at high risk for falls
g. Asher sleeps a lot at baseline

How can Asher's caregivers and coaches support him as he recovers?

a. Encourage an immediate return to football practice
b. Ensure Asher knows he should take his time returning to activities and only return to football when a medical professional has cleared him
c. Encourage Asher to push through worsening symptoms during practice
d. Advise Asher that he should not return to contact sports in the future

Section 5: Signs and Symptoms

Each concussion has a unique combination of circumstances, including biomechanical forces, direction, rotation, source, and location, which explains why concussions and their symptoms can be so varied and unpredictable at times (Danielli et al., 2023). Each person experiences symptoms differently, and symptoms may change as they recover. Typically, symptoms are most severe immediately following the injury, especially in the first 24-48 hours. Sometimes concussion symptoms may take hours or days to become apparent and are more difficult to identify, especially in younger children, who may not be able to verbalize how they are feeling (CDC, 2025f). It is important for healthcare workers to understand that the symptoms of a concussion can vary by person and by particular head injury. Even if someone has experienced a concussion in the past, they may have different symptoms and a different timeline for recovery than in their previous experience (CDC, 2025f).

The general symptoms of concussions can include headache, tinnitus, nausea, vomiting, fatigue, and vision changes. Patients may also report feeling confused or having brain fog. They may have amnesia surrounding the injury event. They may also report dizziness. When a head injury that results in a concussion is witnessed, observers may report a temporary loss of consciousness, slurred speech, delayed response when asked questions, appearing dazed, and forgetfulness. They may report that the individual repeatedly asked the same question. Symptoms that may appear in the days and weeks following a concussion include trouble with concentration and memory, irritability, sensitivity to light and noise, sleep disturbances, emotional changes, depression, and changes in taste and smell (Mayo Clinic Staff, 2024).

Headaches following a concussion have a prevalence of 30-90%. This type of headache is considered post-traumatic and due to secondary injury. Headaches

often occur approximately a week following the injury. Symptoms of a post-injury headache include nausea, vomiting, sensitivity to light, and fatigue. These headaches are considered acute if they fully resolve within 3 months, and chronic if they persist beyond that time (Ahmed et al., 2024).

Cognitive deficits are a common symptom of a concussion, though they have been researched more fully in relation to sports-related concussions. While information from the patient regarding their cognitive status is important, it is especially important to have a more objective way to gather this information, especially from athletes who may or may not be candid about symptoms in hopes of returning to play more quickly. Neuropsychological tests and EEG can be used to provide a more objective assessment of symptom severity. This type of testing also provides a more accurate assessment of physiological recovery, as physiological recovery may take longer than clinical recovery, which is assessed through neurocognitive testing (Ahmed et al., 2024).

Motor impairments, including delayed reaction times, can be a symptom of concussion. Research suggests that activities requiring greater motor coordination are more impaired than those that require less coordination. One study that compared motor coordination between adolescent athletes who had experienced a concussion within the previous two weeks and those who had not experienced an injury found that there was no significant difference in the stance of these individuals, but that those who had experienced a concussion did have a slower gait than those who had not been injured. Another study that explored the relationship between concussion and reaction time found that the reaction time after experiencing a concussion was significantly slowed (Ahmed et al., 2024).

Prolonged symptoms of concussion can be categorized as physical, cognitive, emotional, and sleep-related. Those who experience physical symptoms following a concussion may report headaches, being bothered by light or noise, dizziness or

balance problems, and feeling tired. They may experience pain in the head or neck, trouble with concentration, problems with vision, increased irritability, lack of energy, inability to concentrate or feeling distracted in bright or noisy environments, headaches related to bright or noisy environments, feeling weak or unsteady when walking, nausea, feeling lightheaded or like the room is spinning, slowed reaction time, trouble making decisions or thinking clearly, and more easily frustrated or angered than usual (CDC, 2025c).

Those who experience cognitive symptoms may report attention or concentration problems, memory problems, or feeling slowed down. When sharing these symptoms with the healthcare team, they may report only being able to focus on tasks for a short time, trouble planning or organizing tasks or activities, and becoming easily frustrated or angered. They may have difficulty learning new information or remembering familiar people, places, or things. They may report challenges following instructions or directions, or becoming more anxious or frustrated than usual. These patients may also report being unable to keep pace with their workload, slower reading or writing, difficulty processing information, less mental energy, difficulty thinking clearly, and trouble formulating thoughts (CDC, 2025c).

Individuals with social or emotional symptoms may experience irritability, anxiety, or depression. They may report feeling less patient than usual, consistently worried or frustrated, less able to manage stress or stressful situations, fearful or overwhelmed, unable to relax, nauseated or lightheaded, rapid breathing or heart rate, and less able to manage stress. Those experiencing depression may report withdrawal from work, school, or friends, feeling helpless or hopeless, a lack of energy or interest in usual activities, trouble making decisions or thinking clearly, and problems with sleep. Individuals who experience sleep-related symptoms following a concussion may report having difficulty waking up or having a shifted sleep schedule following their injury. They may report feeling more irritable or

easily angered, lacking energy, feeling tired or groggy, having trouble making decisions or thinking clearly, and experiencing slower reaction time (CDC, 2025c).

Young children may present differently following a head injury compared to older children and adults. They are less likely to experience a loss of consciousness, vomiting, headache, and drowsiness, but are more likely to be irritable. Caregivers may report changes in feeding, stomachaches, regression in toilet training, and increased clinginess. Other symptoms noted of concussion in early childhood include being easily distracted, needing more repetition, clumsiness, speech changes, holding their head, appearing pale, rubbing eyes, not wanting to go outside, longer or more frequent sleeping episodes, increased crying or tantrums, lack of interest in usual preferred activities, saying close to the parent, wanting to be held, and not wanting to be alone. Compared to uninjured children and children with orthopedic injuries, young children who experience a concussion tend to experience elevated physical, cognitive, and behavioral symptoms for ten days to one month post-injury (Beauchamp et al., 2024).

When young children experience a concussion, it can be difficult to determine symptoms, as the child is not able to verbalize or accurately identify their symptoms. Rapid developmental changes during this time also require different measures, making it difficult to accurately assess changes in symptoms. Behavior and cooperation during the early developmental stages can also pose challenges to test validity. While researchers may agree on a diagnostic tool for children, it will likely still not be appropriate for toddlers and infants. Another challenge is determining when a child has fully recovered from their injury. More research is needed to help the healthcare team identify concussions in very young children and provide education to their caregivers on how to support recovery (Beauchamp et al., 2024).

Females may experience concussions differently from males. In adolescents, while girls are more likely than boys to report a sports-related concussion, they experience the effects of a concussion differently. Research suggests that mental health issues due to concussion symptoms are more common in girls. Girls are also more likely to report longer-lasting and more severe symptoms following concussion (CDC, 2026).

Sometimes it may be challenging for the healthcare team to determine what symptoms are due to a concussion and what symptoms may have been present before the injury. Symptoms, such as migraines, anxiety, depression, post-traumatic stress disorder, attention difficulties, and sleep dysfunction, can exist as a result of a concussion or may be pre-existing (Ferry & DeCastro, 2023).

Healthcare workers must be able to recognize symptoms associated with a concussion that may indicate a life-threatening injury. These symptoms include seizures, disorientation to person or place, repeated nausea or vomiting, increased confusion or agitation, unusual behavior, loss of consciousness with increasing drowsiness, inability to stay awake, motor difficulties such as slurred speech, weakness, or numbness, worsening headache that is not relieved, unequal pupils, or reports of double vision. In children, symptoms warranting concern for more serious injury include those for adults, as well as inconsolability and inability or refusal to eat (CDC, 2025f).

Section 5 Personal Reflection

What are some general symptoms associated with concussions? What symptoms may persist? How can it be helpful to identify the types of symptoms a patient is experiencing? What are some physical, cognitive, emotional, and sleep-related symptoms a patient can experience after a concussion? Why is it more difficult to identify symptoms related to a concussion in young children?

Case Study

Upon arrival at the emergency department, Asher complains of a headache and nausea. He has not vomited. He also states he feels very sleepy.

What other symptoms would be expected findings following a concussion? Select all that apply.

a. Symptoms of a basilar skull fracture
b. Confusion
c. Fever
d. Amnesia surrounding the events of the injury
e. Reduced reaction time

What symptoms should the healthcare team monitor for that could indicate the development of life-threatening complications? Select all that apply.

a. Loss of consciousness with increasing drowsiness
b. Worsening headache
c. Normal resting heart rate
d. Unequal pupils
e. Slurred speech
f. Absence of vomiting

Section 6: Diagnosis and Treatment

When an individual sustains a head injury, they should be evaluated by a healthcare professional. In some cases, this may mean an evaluation by an athletic trainer at the sideline of an athletic event, while in other cases it may mean seeking care at a clinic or emergency department. An evaluation for concussion includes an evaluation of mental status and neurological assessment. The Glasgow Coma Scale (GCS) is one tool that may be used in an acute setting. Cranial nerve function assessment, including evaluation of motor strength, balance, and coordination, is also necessary. The Sport Concussion Assessment Tool (SCAT6) is also used, especially in the acute phase of an injury. Although imaging is not usually part of an assessment for concussion, it may be indicated based on specific criteria. MRI is not used for concussion diagnosis, but may be helpful when a patient has an atypical recovery course or abnormal neurological deficits (Ahmed et al., 2024).

The Centers for Disease Control and Prevention recommends a three-step process to ensure safety when treating patients for a concussion. The first step is to assess. This includes examining for clinical findings that could indicate a more severe traumatic brain injury, such as pupillary asymmetry. Providers should also identify factors that may impact the management of the concussion, including concurrent injuries, baseline conditions, and oculomotor dysfunction. The assessment should include identifying other factors that could contribute to the current symptoms, such as dehydration, cervical tenderness, or scalp hematoma. Validated clinical decision tools should be used to determine if imaging is necessary, though it is not routinely recommended. Some risk factors that, in combination, may indicate a need for diagnostic imaging include age less than 2 years old, recurrent vomiting, loss of consciousness, severe mechanism of injury, severe or worsening headache, amnesia, non-frontal scalp hematoma, a GCS score less than 15, or suspicion of a skull fracture. Validated tools should be used to assess symptoms. Examples of

these tools include the Post-Concussion Symptom Scale, Health and Behavior Inventory, Post-Concussion Symptom Inventory, and Acute Concussion Evaluation (CDC, 2025e).

It is essential that the healthcare team assess the patient for risk factors that could indicate a prolonged recovery following a concussion (CDC, 2025a). In the pediatric setting, these risk factors include older age (children and adolescents) and Hispanic ethnicity. Risk factors also include lower socio-economic status, history of intracranial injury, prior history of concussion, presence of a neurological or psychiatric disorder, learning difficulties or lower cognitive ability, and family or social stressors (CDC, 2025e). Female patients are more likely than male patients to experience post-concussive syndrome (CDC, 2025c).

A physical exam of someone who has a suspected concussion includes a close examination of the head and neck to assess for any structural injuries. This is followed by a thorough neurological exam. This neurological exam should include an assessment of strength, sensation, reflexes, ocular movement, and balance. The patient's cognitive function should also be assessed, especially their orientation to person and place, and higher-level cognitive processing. Caregivers can provide baseline information so the provider can more accurately compare the patient's current emotional state to what is normal for that person (Ferry & DeCastro, 2023).

An official diagnosis of concussion is made based on the patient's history and exam findings, but there is no specific criterion that outlines which symptoms or how many concussion symptoms must be present to determine if an individual has a concussion. In the prehospital setting, such as on a sports sideline, there are tools that can help determine whether an individual has experienced a concussion (Ferry & DeCastro, 2023).

The Sports Concussion Assessment Tool 6 (SCAT6) is often used by athletic trainers and sports medicine providers on the sideline to assess athletes who have experienced a head injury. There is also a pediatric version of this tool, the Child SCAT-6, which can be used for patients ages 5-12. Ideally, this tool is used in a quiet setting with limited distractions (Ferry & DeCastro, 2023). The SCAT6 is intended as an aid in the evaluation of a sports-related head injury and is not a stand-alone diagnostic tool. It is possible for athletes who have experienced a concussion to perform normally when using this tool and for those who have not experienced injury to perform poorly. Therefore, the evaluator needs to consider this in the full context of the post-injury exam. This tool is also not intended to determine whether an athlete can return to play. The SCAT6 is intended for use within the first 72 hours of injury but can be used up to seven days post-injury. While preseason testing with the SCAT6 can provide valuable information, a baseline is not required for its use following a head injury (Echemendia et al., 2023).

The SCAT6 utilizes an integrated set of assessments of several domains of functioning. There are six steps to the assessment tool that should be completed sequentially; significant alterations in findings at any point may end the use of the tool and require contacting emergency services for hospital transport. The six steps assess observable signs, the Glasgow Coma Scale, cervical spine assessment, coordination and ocular/motor screening, memory assessment, and red-flag assessment. In the first assessment category of observable signs, red-flag signs should be reviewed. If at any time red flags are identified, the exam should end, and the individual should receive an immediate medical assessment or be transported to a hospital. Observable signs used for the assessment may be witnessed in person or observed on video. When assessing immediate memory, each piece of that portion of the test should be asked three times, regardless of the correctness or incorrectness of the individual's answers. When an athlete

experiences an injury to the head, they should immediately be removed from play, assessed, and monitored for signs and symptoms related to a concussion. If it is determined they have experienced a concussion, they should not return to play that day and should be referred for appropriate follow-up care(Echemendia et al., 2023).

The SCOAT6, or Sport Concussion Office Assessment Tool, can be used to evaluate a sports-related injury in patients aged 13 and older if the injury occurred more than 7 days before testing. Although designed for use more than 7 days after the injury, this tool can be used as early as 72 hours post-injury. There is also a version of this form for children under age 13. In addition to a guided assessment, the SCOAT6 provides strategies for returning to school and sports, with specific steps for resumption of activities. In both academic and athletic contexts, these guidelines provide steps to be followed sequentially, and the individual should not progress to the next step until they have achieved the goal of the previous step (Echemendia et al., 2023).

While imaging studies are not used to diagnose a concussion, they may be used to rule out other conditions, such as a skull fracture. The most commonly used imaging study in these instances is a computed tomography (CT) scan, which allows the healthcare team to rule out injuries that may require emergency surgical intervention quickly. There are tools the healthcare team can use to determine if imaging is necessary. In the adult population, the Canadian Head CT Rule is often used, while the Pediatric Emergency Care Applied Research Network (PECARN) is used for the pediatric population (Ferry & DeCastro, 2023). Another commonly used tool is the New Orleans Criteria (Javeed et al., 2024).

The Canadian CT Head Rule is a clinical decision rule that can be used to determine when a head CT is indicated following a minor head injury. This rule can be used for individuals who have experienced a minor head trauma accompanied

by loss of consciousness, have a GCS of 13-15, confusion, or amnesia following the event, but should not be used for those who are on anticoagulant therapy or have a bleeding disorder, are less than 16 years old, or have experienced a seizure. The rule categorizes risk factors as high or low risk for the need for neurosurgical intervention. High risk factors include a GCS less than 15 two hours post injury, a suspected open skull fracture, signs of a basal skull fracture, two or more episodes of vomiting, or age of 65 years or greater. Medium risk factors include amnesia for more than 30 minutes following the event, a dangerous mechanism or injury, such as a pedestrian being struck by a motor vehicle or a fall from more than three feet or five stairs high. If the patient being evaluated has none of the risk factors, according to the Canadian CT Head Rule, a CT of the head is not necessary. However, if any risk factors are present, a head CT should be obtained. Research has found that this rule is highly sensitive in identifying patients who require neurosurgical intervention (Javeed et al., 2024).

The New Orleans Criteria indicate that a head CT should be obtained if a patient experiences a minor head injury accompanied by at least one high-risk factor, such as headache, vomiting, age greater than 60 years, drug or alcohol intoxication, persistent short-term memory deficits, visible trauma above the clavicle, or a seizure. This criterion should be used only for patients with a GCS score of 15. The sensitivity of this tool is similar to that of the Canadian CT Head Rule. However, in clinical studies, the New Orleans Criteria were less specific for the need for neurosurgical intervention than the Canadian CT Head Rule (Javeed et al., 2024).

A normal head CT does not rule out the presence of a concussion (Ferry & DeCastro, 2023). If CT does not show evidence of hemorrhage and there are no other medical criteria that indicate inpatient care, hospitalization of those who have experienced a concussion while on anticoagulation or antiplatelet therapy is not necessary (CDC, 2025c).MRI may be indicated if symptoms persist for more than seven days. For research purposes, functional MRI or PET scans may be used,

but these are solely for research data and are not necessary for clinical diagnosis or treatment (Ferry & DeCastro, 2023).

After a concussion is diagnosed, the patient should be supervised by someone who has been informed of the warning signs of worsening injury. Those who have more concerning symptoms or more severe injuries may require hospital observation. Treatment for a concussion primarily focuses on supportive care. This includes limiting physical and cognitive activities and gradually returning to them. There is no specific guideline specifying how much physical or cognitive rest should be taken; however, patients should return to these activities slowly, with careful monitoring for symptom recurrence or worsening. If symptoms return, activity should be reduced until symptoms improve. It is advised that this return to activity be a stepwise process, with 24 hours in between increases in length or intensity of the activity. Athletes who have experienced a concussion should not return to play until they have been cleared to do so by a healthcare provider (Ferry & DeCastro, 2023).

With the identification of specific symptom profiles, providers may recommend targeted therapies and interventions. This approach may indicate cognitive-behavioral therapy for patients experiencing mood disturbances or vision training for patients with oculomotor dysfunction. More research is needed to determine the necessity and efficacy of this targeted approach. Medications used to treat a concussion typically include over-the-counter analgesics to help control pain associated with headaches. While other medications may be more effective for pain control, they can mask changes in the patient's mental status, sleep patterns, mood, or other symptoms that could indicate worsening injury (Ferry & DeCastro, 2023).

Scientists continue to identify factors that affect the diagnosis and management of concussions. Further research is needed, though a recent study found that social

determinants of health can impact recovery following a concussion. The specific social determinants of health that appear to affect recovery include economic stability, access to and quality of education, and social and community context (Hunt et al., 2025).

The prognosis following a concussion is typically positive, and most patients experience an improvement in symptoms within one to two weeks following their injury. Recovery is variable, so it is important to monitor patients and recognize that recovery times are unique for each patient and each concussion. Typically, increased symptom intensity at the time of injury is associated with a longer recovery period (Ferry & DeCastro, 2023).

Some tips may help relieve symptoms. For those who experience headaches, in addition to over-the-counter medications that the provider may suggest, patients should be encouraged to stay well-hydrated. They can try relaxation strategies to reduce muscle tension in the head, neck, and face. Shortened work or school days, reduced light and noise, and limited screen time may also help. Patients who are bothered by light may experience relief by wearing sunglasses or a hat when outside for a few days to weeks after their injury. They should gradually reduce the use of these items as symptoms allow. For those experiencing symptom exacerbation with noise, it may be helpful to avoid large crowds or wear earplugs or headphones to reduce environmental noise. Like the suggestions for those bothered by light, the use of these interventions should be gradually reduced to allow the brain to tolerate this sensory input. Reducing screen time can also help. Individuals who experience balance problems or dizziness may benefit from vestibular therapies if symptoms persist after 2-3 days. They should use precautions to avoid a fall, such as using a cane or walker. Those who feel excessively tired following a concussion may benefit from frequent rest breaks in a quiet place as needed, switching between activities every 30 minutes, mild

exercise that increases heart rate as tolerated, and a shortened school or work day if symptoms persist (CDC, 2025c).

Patients who complain of attention or memory problems may benefit from reducing background noise and distractions while working. They should prioritize the most important activities when their concentration is at its best. These patients may need to discuss workplace or school support to help accommodate their recovery. These may include a shortened workday or workload, breaking tasks down into smaller assignments, and extended time to complete them. Those who experience memory challenges may benefit from writing down important information or tasks, setting reminders, asking teachers or employers to repeat key directions or information, or breaking them down into smaller chunks. They can also benefit from creating associations of information with familiar things, such as events, objects, or people. Those who feel unable to keep up with the cognitive pace required to do their work should take rest breaks during the day and may benefit from extended deadlines. Students may need to request increased time to learn new information (CDC, 2025c).

Those who experience social or emotional symptoms may also benefit from tips that can help aid recovery. Those who experience irritability or feel easily angered may see symptom improvement by taking frequent rest breaks in a quiet place during the day, practicing relaxation exercises such as deep breathing or meditation, sharing their feelings with a trusted friend or loved one, and seeking opportunities to reduce stress. Individuals who experience anxiety or nervousness should be encouraged to share their symptoms with their healthcare provider, as some treatments may be beneficial. Relaxation exercises, extended time to complete tasks at work or at school, and talking to a trusted friend or loved one can also help. Those who report sadness should also share this symptom with their healthcare provider. They should be encouraged to participate in social and leisure activities even if they do not feel like participating, if it is not associated

with worsening acute concussion symptoms. Mild low-impact exercise, talking to a friend or loved one, and avoiding alcohol can also help. Resources for mental health crisis support should be shared with these patients (CDC, 2025c).

Individuals who experience sleep problems can benefit from implementing good sleep hygiene routines. They should be advised to keep a set bedtime routine with fixed sleep and wake times as much as possible. Mild exercise can also support healthy sleep. They should avoid or limit caffeine-containing foods and drinks, as these can contribute to nighttime wakefulness. A later work or school start time can also help these patients, as well as rest breaks throughout the day. Screen time and loud music should be avoided in the hours leading up to bedtime. Sleep quality may also be improved by sleeping in a dark, cool room (CDC, 2025c).

Section 6 Personal Reflection

How is a concussion diagnosed? What is the SCAT6? Why do you think this tool is important for athletes? How can the SCAT6 help healthcare workers perform a comprehensive assessment following a concussion? What are some tips that can help with recovery following a concussion? How is the SCOAT6 used in concussion management?

Case Study

Asher's assessment determines he likely has experienced a concussion. How can the healthcare team decide if he needs a CT of the head?

a. Utilize a validated guidance tool to determine if any risk factors are present that might require neurosurgical intervention.

b. If he has not lost consciousness, he will not need a CT scan.

c. Plan for a CT scan, as they are required for all head injuries.

d. If the patient has a headache following a head injury, they should have a CT scan of the head to rule out an intracranial hemorrhage.

Asher's caregiver asks why the doctor did not order an MRI of the brain. What can you tell his caregiver? Select all that apply.

a. CT scans are used to diagnose concussions, not MRIs.

b. MRIs do not provide information necessary for the diagnosis and treatment of a concussion.

c. MRIs are primarily used for clinical research purposes with head injuries

d. Pediatric patients never undergo MRI

e. Imaging may be ordered if specific risk factors are present

f. MRIs increase the risk of second-impact syndrome

What are some tips that may help Asher and his caregiver manage concussion-related symptoms? Select all that apply.

a. For at least the first day or two, rest as much as possible

b. Do not participate in aerobic exercise until instructed to do so

c. A quick return to contact sports will help Asher's brain heal

d. Reducing bright lights and sounds may help reduce symptoms

e. Take opioids for pain management if symptoms are worsening

f. Quiet breaks throughout the day may help

g. Social isolation can help reduce concussion symptoms

What recovery supports may be required as Asher returns to school

a. Complete all make-up work as soon as possible
b. Allowing for extended time on assignments and breaking instructions into chunks.
c. Asher should return to school for the full school day after he returns to sports.
d. After a concussion, Asher will need to recover outside of school for at least one year.

Section 7: Complications

Patients can experience complications related to a concussion. The most common complication is post-concussion syndrome. This occurs when symptoms persist for weeks or months after the head injury occurs. When someone experiences post-concussion syndrome, they can experience any of the symptoms associated with concussion, though the most common include multiple symptoms. The development of post-concussion syndrome cannot be predicted and does not correlate with the severity of the initial injury. However, it is more likely to occur when the individual has experienced prior concussions (Ferry & DeCastro, 2023).

Post-concussive syndrome occurs when certain concussion-related symptoms occur together. Individuals who have experienced a prior concussion are at increased risk of post-concussive syndrome. Symptoms can be physical, cognitive, behavioral, or emotional and can include headache, fatigue, vision changes, balance changes, confusion, dizziness, insomnia, and difficulty concentrating. According to the ICD-10, this condition is diagnosed when these symptoms persist

for more than three weeks. The DSM-IV is more specific when providing diagnostic criteria related to post-concussive syndrome. It defines it as the presence of cognitive deficits in attention or memory, along with three qualifying symptoms, including fatigue, sleep disturbance, headache, dizziness, irritability, affective disturbance, apathy, or personality changes that last for three months or more (Permenter et al., 2023).

It is estimated that 15% of individuals who experience a concussion experience post-concussion syndrome. However, this rate is most likely higher due to a lack of identification or documentation of the condition. Previously, it was thought that more significant brain injuries had a higher association with post-concussive syndrome; however, research has not been able to establish a correlation between the severity of the injury and the likelihood of the occurrence of post-concussive syndrome. In most cases, post-concussive syndrome resolves within 10-14 days; however, when symptoms persist for more than three months, the condition is referred to as persistent post-concussive syndrome and is more likely to have long-lasting effects on cognition, memory, learning, and executive function (Permenter et al., 2023).

There is no specific treatment for post-concussive syndrome that differs from recommendations for recovery following a concussion; however, some medications may be used to manage headache symptoms. Cervical physical therapy, vision therapy, or vestibular rehabilitation may be used for patients who continue to experience visual and balance problems. Research has also found that those with post-concussive syndrome who engage in low-level exercise recover more quickly. Although the return-to-play protocol differs, the Buffalo treadmill tests are used to guide recommendations for return to activity for non-athletes. This test measures the patient's ability to achieve the target heart rate for their age without experiencing symptoms or premature fatigue. Once they can achieve this for at least 20 minutes on 2-3 consecutive days, evidence suggests they can

be considered physiologically recovered. For athletes, achieving a positive result on this test may be used to determine whether they can return to aerobic training, even if they are not yet able to return to play. While the prognosis for post-concussive syndrome is positive, in rare cases, symptoms can persist for several months or a year and are more likely to be associated with emotional symptoms (Permenter et al., 2023). Patients who are at high risk for post-concussive syndrome should be referred to outpatient care (CDC, 2025c).

Second impact syndrome is a rare complication of concussion that occurs when an individual who has experienced a concussion has a repeated head injury before their first concussion has fully resolved (Ferry & DeCastro, 2023). When the brain has experienced a concussion, resulting metabolic abnormalities may make it more susceptible to further injury (May et al., 2023). This impact on the already injured brain can lead to rapid and severe brain swelling, causing brain herniation and death (Ferry & DeCastro, 2023). Athletes who experience a concussion and return to sports before they are fully recovered are at increased risk for second impact syndrome. Due to its rarity, the prevalence of second impact syndrome is unknown (May et al., 2023).

When second impact syndrome occurs, the individual rapidly develops altered mental status and loss of consciousness within seconds to minutes following impact, leading to devastating neurological injury. When a second impact occurs, cerebral blood flow can become dysregulated, leading to a rapid increase in intracranial pressure and brain herniation, resulting in death within two to five minutes. Treatment of this condition is limited. Due to its rarity, there is little associated research and understanding of the condition. Prevention of second impact syndrome is essential. This can be achieved through individualized recovery recommendations following a concussion and careful, gradual return to play (May et al., 2023).

First identified in boxers in the early twentieth century (Donison et al., 2025), chronic traumatic encephalopathy (CTE) occurs when an individual has experienced repeated head trauma, leading to the deposition of tau proteins in the brain (Ferry & DeCastro, 2023). This can cause slow, progressive neurodegeneration, similar to what is seen in other dementia related conditions, such as Alzheimer's disease (Ferry & DeCastro, 2023). While there are similarities between CTE and other tauopathies, such as Alzheimer's disease, the tissue pathology of CTE is unique to those who have experienced repeated traumatic brain injury and impacts to the head (Donison et al., 2025). Symptoms of CTE may include memory deficits, behavior and personality changes, or abnormalities in speech or gait (Ferry & DeCastro, 2023). Executive function can be impaired. Individuals may also experience florid dementia, or the shrinking of the brain. Behavior changes may include violence, impulsivity, aggression, and psychiatric disorders (Donison et al., 2025).

The incidence and prevalence of CTE are unknown, as some individuals may not exhibit symptoms or may have other diagnoses that produce similar symptoms. This condition can only be definitively diagnosed by examining the brain after the patient's death. Current research regarding CTE focuses on exploring the relationship between concussion and CTE (Ferry & DeCastro, 2023). Subconcussive brain injuries, or injuries to the brain that do not produce symptoms, can also contribute to CTE. Current research focuses on developing diagnostic biomarkers and therapeutic interventions to prevent CTE. Recent evidence suggests that imaging and fluid biomarkers may detect changes in tau proteins before the development of CTE-related symptoms (Donison et al., 2025). There is no cure for CTE, and progression eventually results in severe cognitive dysfunction and neurodegeneration. Individuals at highest risk for CTE include athletes who participate in contact sports and those who have served in the military. Younger individuals are more likely to exhibit mood and behavior changes, while older

individuals are more likely to experience cognitive impairment and dysfunction. There is a correlation between an increased number of concussions and higher rates of cognitive, sleep, and neuropsychiatric symptoms associated with CTE. Risk for CTE can be reduced by implementing effective concussion recovery and "return-to-play" protocols (Munakomi & Puckett, 2024).

If symptoms do not resolve as expected with standard care after 2-4 weeks, the patient should be referred to a specialist. In some areas, a specialist may not be accessible in person, though telehealth may be an option. If symptoms are acutely worsening, neuroimaging should be considered. Non-opioid analgesia and multidisciplinary evaluation may be necessary for patients who experience chronic headaches following a concussion. Vestibular rehabilitation may be required for those with vestibulo-ocular dysfunction. Education on sleep hygiene or a consultation with a sleep specialist may be necessary if sleep problems worsen. Treatment for cognitive impairment should target the etiology and include a neuropsychological evaluation. Psychotherapeutic evaluation and treatment are necessary for those who continue to experience emotional dysfunction following a traumatic brain injury (CDC, 2025e).

Section 7 Personal Reflection

What are complications related to a concussion? What is post-concussive syndrome? How can post-concussive syndrome impact an individual's daily life? What causes second-impact syndrome? How can second-impact syndrome be avoided? What is CTE? Why do you think CTE was first identified in athletes, and boxers in particular? What treatments may be necessary for patients who have experienced a concussion?

Case Study

Asher's caregiver states she knew someone who had a sports-related concussion and then died after another head injury occurred the day after a similar injury.

What is some reassuring information that can be shared with Asher's caregiver? Select all that apply.

a. Asher has received all vaccines on time, reducing his risk for concussion-related complications.

b. Asher has not had a seizure, so he is not at risk for post-concussion syndrome.

c. Asher is at low risk of injuries.

d. Asher is alert and oriented. His mental status has not declined since his injury.

e. A tool to determine the necessity of a head CT was used, and it was determined that Asher was not at increased risk for complications.

f. Death following a concussion cannot be prevented and is often associated with a repeated concussion before the brain has had an opportunity to heal.

When should Asher return to school?

a. The day after the injury

b. He should return gradually as symptoms allow

c. He should return immediately and push through symptoms

d. Asher should be permanently homeschooled following a head injury

When should Asher return to football?

a. The day after the injury

b. He should return gradually, as symptoms allow, and once cleared by a medical professional.

c. One year after his injury

d. Once someone experiences a concussion, they should no longer play contact sports.

What information should the nurse share to help reduce complications following a concussion?

a. The risk of complications is reduced when patients rest from all activities for at least three months.

b. Return to activities is gradual because if the patient ignores symptoms and returns to play too soon, they are at increased risk for another concussion. Concussions that occur before the brain is fully recovered can have devastating consequences.

c. Routine MRI testing can reduce the risk of post-concussion complications.

Section 8: Patient Education

Patient and family education following a concussion is essential. Nurses should ensure that both patients and their caregivers understand warning signs that may indicate a more serious injury. These warning signs include a persistent or worsening headache, significant nausea or repeated vomiting, increased confusion, agitation, or restlessness, slurred speech, drowsiness, or inability to wake up, weakness, numbness, decreased coordination, loss of consciousness,

convulsions, or seizures (CDC, 2025e). Patients should keep track of their symptoms and communicate them to their healthcare provider (CDC, 2025c).

Patient education should include information on what to expect with a typical recovery following a concussion (CDC, 2025e). This includes common symptoms that they may experience. They should be advised on ways to manage their recovery, such as prioritizing quality nighttime sleep and light activity, like going on a walk. They should also be advised to monitor light activity for how it affects symptoms. If symptoms worsen, they should stop the activity and rest. Patients should minimize screen use and exposure to bright lights and loud noises if their symptoms worsen. Aerobic exercise for 20-30 minutes can aid recovery (CDC, 2025c).

Both patients and caregivers should be educated regarding ways to prevent further injury following a concussion (CDC, 2025e). Adults and pediatric patients are often eager to return to work, school, and their usual activities, but they should be educated that this process should not be rushed. They should be advised that a repeat injury before their brain is fully healed can slow recovery, lead to long-term problems, or, in rare cases, lead to death (CDC, 2025c). Helmets should be used for indicated sports 100% of the time. These activities include baseball and softball when batting, cycling, football, hockey, horseback riding, using powered recreational vehicles, riding skateboards or scooters, skiing, and wrestling. Headgear is recommended for participation in martial arts, pole vaulting, and soccer (Agarwal et al., 2024).

There are steps individuals can take to reduce the risk of experiencing a concussion. Since falls are the leading cause of concussions in children, falls in younger children can be prevented by using window guards, stair gates, and handrails. Appropriate supervision can also reduce the risk of experiencing a concussion. Children should be properly secured in a vehicle using the appropriate

car seat type for their age and size. Adolescents who are learning to drive can reduce the risk of a concussion by learning about driver safety. Wearing a helmet when bicycling, skateboarding, skiing, snowboarding, riding a scooter, or playing contact sports can significantly reduce the risk of a concussion. However, these must be worn correctly and should be replaced when damaged. Bicycle helmet laws have been implemented in many states and have significantly reduced the prevalence of serious head injuries, including concussions. Anyone operating or riding as a passenger on an all-terrain vehicle (ATV) should wear a helmet. The American Academy of Pediatrics recommends that the minimum age to ride an ATV is 16 years. Playgrounds with a soft surface, such as mulch or sand, rather than grass and dirt, can reduce the risk of concussion if a fall occurs (CDC, 2025d).

Activity-related head injuries may be prevented in many ways. Younger children should be supervised at all times and should not use sporting equipment or play sports that are not appropriate for their age. Individuals should not dive in water less than nine feet deep. All facility rules should be followed at water parks and swimming pools. Clothing should be appropriate for the sport or activity. Clothing that interferes with vision should not be worn. Individuals should not participate in sports when they are sick or very tired. Drivers and cyclists should obey all traffic signals. Cyclists and skateboarders should be aware of vehicles moving near them and avoid uneven or unpaved surfaces. Sports fields, playgrounds, and equipment should be routinely inspected, and damaged items should be discarded or replaced. Individuals should wear a seat belt 100% of the time when driving or riding in a motor vehicle. Individuals should never drive while under the influence of drugs or alcohol, and passengers should never ride with drivers who are under the influence of these substances. Firearms should be stored in a locked cabinet or safe, and ammunition should be stored in a separate, secured location. Hazards that could contribute to a fall should be removed from the home, including unsecured rugs and loose electrical cords. Toys should be put

away, and safety gates and window guards should be installed as appropriate. Some individuals may benefit from installing grab bars or handrails in the home, especially in the shower or on the staircase (Agarwal et al., 2024).

Patient education must include information on when to alert the healthcare team of concerning symptoms or events, or factors that could complicate recovery. Patients should be advised to inform the healthcare team of all medications and supplements they take, as some may complicate recovery. They should notify the healthcare team if they have fallen or feel unsteady, if they consistently need medications for headaches or other symptoms, if symptoms worsen or persist, or if they experience mental health symptoms (CDC, 2025c).

Patients and their caregivers must understand the importance of gradually reintroducing activity (CDC, 2025e). Patients may need to work with their employer to create a plan to ease back into a full workload. They may require breaks and support at work. Some employers may have support services that can be helpful. Patients should be encouraged to inquire if their employer offers this benefit (CDC, 2025c).

Those who have experienced a concussion may require additional social or emotional support. Patients and caregivers should understand that this is normal (CDC, 2025e). Patients should be advised to stay connected to friends, loved ones, and their healthcare team, and ask for help when needed (CDC, 2025c).

While clear teaching is always necessary for effective patient education, due to the nature of concussions and associated symptoms, it is especially important that instructions are explicit regarding return to activity, both academic and athletic, and that these instructions are personalized to the patient's needs. Patient education following a concussion should be presented both verbally and in writing. Typically, return-to-activity guidelines include beginning light activity after 1-2 days of physical and cognitive rest. This does not include a return to

sports. Activities should be reintroduced gradually if they do not significantly worsen symptoms. School-related needs and progress must be monitored in collaboration with parents and school professionals. Patients and caregivers should understand that a gradual return to sports should not begin until the patient can tolerate their usual activities without worsening symptoms. They should also understand that returning to contact sports cannot occur until they are symptom-free during exertion without pain relievers (CDC, 2025e).

Returning to work and driving is similar to returning to educational activities. Following a concussion, adults should gradually increase non-athletic activity if symptoms do not worsen. Individuals may require more time off from work if they are having difficulty thinking or concentrating. They may also need more time before returning to work if they are experiencing symptoms such as dizziness, vision problems, or delayed reaction time. Individuals who work from heights or whose job poses an increased risk of falling, such as those who work on ladders or roofs, may need to take more time before returning to work, as another head injury could cause second-impact syndrome. Individuals who operate or drive heavy machinery, work with hazardous materials, or work in an environment with increased safety risks, or those who work in high-stress environments, should also take increased time off from work to promote safe recovery following a concussion (CDC, 2025c).

Patients who have experienced a concussion should be advised to follow up with their regular healthcare provider within a few days following the injury to assess symptoms and recovery progress (CDC, 2025c).

Section 8 Personal Reflection

What are the necessary things the nurse should include in patient education following a concussion? Why do you think post-concussion patients must be

educated both verbally and in writing? How can knowing what to expect following a concussion be helpful for patients and their caregivers? What information should be shared regarding returning to work? What factors could require the modification of a recommendation? What are some strategies that can be used to reduce the risk of a future concussion?

Case Study

The nurse is preparing Asher for discharge. What information is important to share with Asher and his caregiver during patient education? Select all that apply.

a. Asher should rest for the next 1-2 days and return to non-exercise activities as tolerated.

b. Asher should avoid falling asleep for at least six hours

c. Asher should stop any activity that worsens symptoms

d. Increased screen time can be helpful in concussion healing

e. Asher may require more emotional support following his injury

f. Symptoms that indicate a worsening condition should be reported immediately

g. Asher should be supervised by someone who understands what symptoms may be concerning if they develop

h. Asher may return to work as soon as he returns to school

i. Precautions should be taken to prevent another concussion from occurring

j. Mild exercise is not beneficial for concussion recovery

k. Asher may need to take quiet breaks throughout the day as he recovers

What are the warning signs Asher and his caregivers should immediately report to the healthcare team? Select all that apply.

a. Increased confusion
b. Increased agitation
c. Slurred speech
d. Hyperfocused attention
e. Usual sleep patterns
f. Seizures

Asher and his caregiver ask about the prognosis following a concussion. What should the nurse tell them?

a. The prognosis following a concussion is often guarded, as this is the most serious type of traumatic brain injury.
b. Prognosis following a concussion cannot be predicted
c. Most patients make a full recovery following a concussion
d. Returning to contact sports and work as soon as possible will improve Asher's prognosis

How can Asher prevent experiencing another concussion? Select all that apply.

a. Wear a helmet when indicated
b. Wear a seatbelt at all times while in a motor vehicle
c. Participate in creative hobbies
d. Reduce risk factors associated with falls

e. Wear protective equipment while playing contact sports

Conclusion

Concussions are widely prevalent, and nurses can expect to encounter patients who have experienced a concussion in many settings. When nurses are aware of the physiologic processes that occur with a concussion, they can have a greater understanding of how brain injuries, even mild brain injuries, affect the daily lives of their patients. While a specific grading system is no longer used to classify concussions, nurses who understand the ways concussions can be grouped to guide treatment are better prepared to promote optimal outcomes. Identifying risk factors for concussion can help guide patient education, and sharing this information may lead to reduced incidence of concussions. Symptoms of concussions can vary greatly, so it is important for nurses to understand these symptoms, as well as symptoms that can indicate developing concussion-related complications. Diagnosis and treatment of concussions should follow evidence-based practice. Multiple tools can be used to ensure a complete post-injury assessment and to alert the healthcare team to red flags that could indicate the need for an escalation in the level of care. It is also necessary for nurses to understand complications associated with a concussion so they may be quickly identified. Patient education is an important aspect of concussion care. Strategies for head injury prevention can help reduce the incidence of concussions. Education that includes evidence-based recommendations about returning to school, work, and sports can reduce complications and support recovery. When misconceptions about concussions are corrected through patient education, awareness of the seriousness of concussions can spread, leading to a cultural shift in the way concussions are viewed.

Nurses play a vital role in caring for patients who have experienced a concussion. In addition to understanding the physiological changes that occur with concussions, nurses can appreciate the way symptoms can impact the lives of their patients. Prolonged symptoms, especially, can be very challenging. When a nurse understands how concussion symptoms affect patients, they are best prepared to provide compassionate, evidence-based care.

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