Chapter 28 - Head and Spine Injuries

1 National EMS Education Standard Competencies (1 of 4)
   Trauma
   Applies fundamental knowledge to provide basic emergency care and transportation based on assessment findings for an acutely injured patient.

2 National EMS Education Standard Competencies (2 of 4)
   Head, Facial, Neck, and Spine Trauma
   • Recognition and management of
     – Life threats
     – Spine trauma

3 National EMS Education Standard Competencies (3 of 4)
   Head, Facial, Neck, and Spine Trauma (cont'd)
   • Pathophysiology, assessment, and management of
     – Spine trauma
     – Skull fractures

4 National EMS Education Standard Competencies (4 of 4)
   Nervous System Trauma
   • Pathophysiology, assessment, and management of
     – Traumatic brain injury
     – Spinal cord injury

5 Introduction (1 of 2)
   • The nervous system is a complex network of nerve cells that enables all parts of the body to function.
   • Includes:
     – Brain
     – Spinal cord
     – Several billion nerve fibers

6 Introduction (2 of 2)
   • The nervous system is well protected.
     – The brain is protected by the skull.
     – The spinal cord is protected by the spinal canal.
   • Despite this protection, serious injuries can damage the nervous system.

7 Anatomy and Physiology (1 of 2)
   • The nervous system is divided into two anatomic parts.
     – Central nervous system
     – Peripheral nervous system

8 Anatomy and Physiology (2 of 2)

9 Central Nervous System (1 of 9)
   • Includes the brain and spinal cord
   • The brain controls the body and is the center of consciousness.
   • Brain is divided into three major areas:
Central Nervous System (2 of 9)

- Cerebrum
  - Controls a wide variety of activities, including most voluntary motor function and conscious thought
  - Contains about 75% of the brain's total volume
  - Divided into two hemispheres with four lobes

Central Nervous System (3 of 9)

- Cerebellum
  - Coordinates balance and body movements
- Brainstem
  - Controls most functions necessary for life
  - Best-protected part of the CNS

Central Nervous System (4 of 9)

- Spinal cord
  - Made up of fibers that extend from the brain's nerve cells
  - Carries messages between the brain and the body via the grey and white matter of the spinal cord

Central Nervous System (5 of 9)

- Protective coverings
  - The entire CNS is contained within a protective framework.
  - The thick, bony structures of the skull and spinal canal withstand injury very well.
  - The CNS is further protected by the meninges.

Central Nervous System (6 of 9)

- Meninges
  - Outer layer (dura mater) is a tough, fibrous layer that forms a sac to contain the CNS
  - Inner two layers (arachnoid mater and pia mater) contain the blood vessels

Peripheral Nervous System (1 of 5)

- 31 pairs of spinal nerves
  - Conduct impulses from the skin and other organs to the spinal cord
  - Conduct motor impulses from the spinal cord to the muscles
  - The spinal nerves serving the extremities are arranged in complex networks.
Peripheral Nervous System

(3 of 5)

- 12 pairs of cranial nerves
  - Transmit information directly to or from the brain
  - Perform special functions in the head and face, including sight, smell, taste, hearing, and facial expressions

Peripheral Nervous System

(4 of 5)

- Two types of peripheral nerves
  - Sensory nerves
    - Carry only one type of information from the body to the brain via the spinal cord
  - Motor nerves
    - One for each muscle
    - Carry information from the CNS to the muscles

Peripheral Nervous System

(5 of 5)

- Connecting nerves
  - Found only in the brain and spinal cord
  - Connect the sensory and motor nerves with short fibers
  - Allow the exchange of simple messages

How the Nervous System Works (1 of 5)

- Controls virtually all the body’s activities, including:
  - Reflex activities
  - Voluntary activities
  - Involuntary activities

How the Nervous System Works (2 of 5)

- Connecting nerves in the spinal cord form a reflex arc.
  - If a sensory nerve in this arc detects an irritating stimulus, it bypasses the brain and sends the message directly to a motor nerve.

How the Nervous System Works (3 of 5)

How the Nervous System Works (4 of 5)

- Voluntary activities are activities we consciously perform.
- Involuntary activities are the actions that are not under conscious control.
- Somatic (voluntary) nervous system handles voluntary activities.

How the Nervous System Works (5 of 5)

- Autonomic (involuntary) nervous system handles body functions
  - Divided into two sections: sympathetic and parasympathetic nervous systems
  - Sympathetic nervous system reacts to stress with a fight-or-flight response.
  - Parasympathetic nervous system has the opposite effect on the body.

Skeletal System (1 of 5)
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- **Skull**
  - Composed of two groups of bones: cranium (thick shell above the eyes and ears that protects the brain) and facial bones.

**Skeletal System (2 of 5)**
- **Skull (cont’d)**
  - Cranium is composed of 80% brain tissue, 10% blood supply, and 10% CSF
  - Four major bones make up the cranium: occiput, temples, parietal regions, and frontal region
  - Face is composed of 14 bones: maxillae, zygomas, mandible, and orbit

**Skeletal System (3 of 5)**
- **Spinal column**
  - Body’s central supporting structure
  - 33 vertebrae are divided into five sections:
    - Cervical
    - Thoracic
    - Lumbar
    - Sacral
    - Coccygeal

**Skeletal System (4 of 5)**
- **Spinal column (cont’d)**
  - Injury to the vertebrae can result in paralysis.
  - Vertebrae are connected by ligaments and separated by cushions, called intervertebral disks
  - Spinal column is almost entirely surrounded by muscles

**Head Injuries (1 of 4)**
- Traumatic insult to the head that may result in injury to soft tissue, bony structures, or the brain
- 52,000 deaths occur annually in the United States as the result of severe head injury.
- Account for more than half of all traumatic deaths

**Head Injuries (2 of 4)**
- Closed injuries
  - The brain has been injured but there is no opening into the brain.
- Open injuries
  - An opening from the brain to the outside world exists.
  - Often caused by penetrating trauma
  - May be bleeding and exposed brain tissue

**Head Injuries (3 of 4)**
- Motor vehicle crashes are the most common MOI.
  - Head injuries also commonly occur:
    - In victims of assault
    - When elderly people fall
    - During sport-related incidents
• In a variety of incidents involving children
  – Any head injury is potentially serious.

**Head Injuries (4 of 4)**

**Scalp Lacerations**
• Can be minor or serious
• Even small lacerations can lead to significant blood loss.
  – May be severe enough to cause hypovolemic shock
• They are often an indicator of deeper, more serious injuries.

**Skull Fracture (1 of 7)**
• Significant force applied to the head may cause a skull fracture.
• May be open or closed, depending on whether there is an overlying laceration of the scalp
• Injuries from bullets or other penetrating weapons often result in skull fractures.

**Skull Fracture (2 of 7)**
• Signs of skull fracture include:
  – Patient’s head appears deformed
  – Visible cracks in the skull
  – Ecchymosis (bruising) that develops under the eyes (raccoon eyes)
  – Ecchymosis that develops behind one ear over the mastoid process (Battle’s sign)

**Skull Fracture (3 of 7)**

**Skull Fracture (4 of 7)**
• Linear skull fractures
  – Account for about 80% of all skull fractures
  – Radiographs are required to diagnose a linear skull fracture because there are no physical signs.

**Skull Fracture (5 of 7)**
• Depressed skull fractures
  – Result from high-energy direct trauma to the head with a blunt object
  – Frontal and parietal bones are most susceptible
  – Bony fragments may be driven into the brain

**Skull Fracture (6 of 7)**
• Basilar skull fractures
  – Associated with high-energy trauma
  – Usually occur following diffuse impact to the head
  – Signs include CSF drainage from the ears, raccoon eyes, and Battle’s sign

**Skull Fracture (7 of 7)**
• Open skull fractures
  – Result when severe forces are applied to the head
  – Often associated with trauma to multiple body systems
  – Brain tissue may be exposed to the environment

**Traumatic Brain Injuries (1 of 3)**
• Most serious of all head injuries
• Two broad categories: primary (direct) injury and secondary (indirect) injury
  – Primary brain injury results instantaneously from impact to the head.
Secondary brain injury increases the severity of the primary injury.

47 **Traumatic Brain Injuries (2 of 3)**
- Secondary injury may be caused by:
  - Hypoxia
  - Hypotension
  - Cerebral edema
  - Intracranial hemorrhage
  - Increased intracranial pressure
  - Cerebral ischemia
  - Infection

48 **Traumatic Brain Injuries (3 of 3)**
- The brain can be injured directly by a penetrating object or indirectly as a result of external forces.
- A coup-countercoup injury can result from striking a windshield.
  - Head hits the windshield; brain comes to an abrupt stop by striking the inside of the skull.
  - Head falls back against headrest; brain slams into the rear of the skull

49 **Intracranial Pressure (1 of 7)**
- Accumulations of blood within the skull or swelling of the brain can rapidly lead to an increase in ICP.
  - Increased ICP squeezes the brain against bony prominences within the cranium.

50 **Intracranial Pressure (2 of 7)**
- Signs of increased intracranial pressure
  - Cheyne-Stokes respirations
  - Ataxic (Biot) respirations
  - Decreased pulse rate, headache, nausea, vomiting, decreased alertness, bradycardia, sluggish or nonreactive pupils, decerebrate posturing, and increased or widened blood pressure.
  - Cushing reflex

51 **Intracranial Pressure (3 of 7)**
- Intracranial hemorrhage
  - Bleeding inside the skull also increases the ICP.
  - Bleeding can occur:
    - Between the skull and dura mater
    - Beneath the dura mater but outside the brain
    - Within the tissue of the brain itself

52 **Intracranial Pressure (4 of 7)**
- Epidural hematoma
  - Accumulation of blood between the skull and dura mater
  - Nearly always the result of a blow to the head that produces a linear fracture

53 **Intracranial Pressure (5 of 7)**
- Subdural hematoma
  - Accumulation of blood beneath the dura mater but outside the brain
  - Occurs after falls or injuries involving strong deceleration forces
– May or may not be skull fracture

54 **Intracranial Pressure (6 of 7)**
   • Intracerebral hematoma
     – Bleeding within the brain tissue itself
     – Can occur following a penetrating injury to the head or because of rapid deceleration forces

55 **Intracranial Pressure (7 of 7)**
   • Subarachnoid hemorrhage
     – Bleeding occurs into the subarachnoid space, where the CSF circulates
     – Results in bloody CSF and signs of meningeal irritation
     – Common causes include trauma or rupture of an aneurysm.

56 **Concussion (1 of 4)**
   • A blow to the head or face may cause concussion of the brain.
     – Closed injury with a temporary loss or alteration of part or all of the brain’s abilities to function without demonstrable physical damage to the brain
     – About 90% of patients do not experience a loss of consciousness.

57 **Concussion (2 of 4)**
   • A patient with a concussion may be confused or have amnesia.
   • Usually a concussion lasts only a short time.

58 **Concussion (3 of 4)**
   • Ask about these symptoms:
     – Dizziness
     – Weakness
     – Visual changes
     – Nausea and vomiting
     – Ringing in the ears
     – Slurred speech
     – Inability to focus

59 **Concussion (4 of 4)**
   • Ask about these symptoms (cont’d):
     – Lack of coordination
     – Delay of motor functions
     – Inappropriate emotional responses
     – Temporary headache
     – Disorientation

60 **Contusion**
   • Far more serious than a concussion
   • Involves physical injury to brain tissue
   • May sustain long-lasting and even permanent damage
   • A patient may exhibit any or all of the signs of brain injury.

61 **Other Brain Injuries**
   • Brain injuries can also arise from medical conditions, such as blood clots or hemorrhages.
   • Signs and symptoms of nontraumatic injuries are often the same as those of traumatic brain injuries.
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- There is no obvious history of MOI or any external evidence of trauma.

62 Spine Injuries (1 of 2)
- Compression injuries can result from a fall.
  - Forces that compress the patient’s vertebral body can cause herniation of disks
- Motor vehicle crashes can overextend the spine.
- Rotation-flexion injuries of the spine result from rapid acceleration forces.

63 Spine Injuries (2 of 2)
- When the spine is pulled along its length (hyperextension), it can cause fractures.
- Any one of these unnatural motions, as well as excessive lateral bending, can result in fractures or neurologic deficit.
- When bones of the spine are altered from traumatic forces, they can fracture or move out of place.

64 Patient Assessment (1 of 2)
- Always suspect a possible head or spinal injury with:
  - Motor vehicle collisions
  - Pedestrian–motor vehicle collisions
  - Falls
  - Blunt trauma
  - Penetrating trauma to the head, neck, back, or torso

65 Patient Assessment (2 of 2)
- Always suspect a possible head or spinal injury with (cont’d):
  - Rapid deceleration injuries
  - Hangings
  - Axial loading injuries
  - Diving accidents

66 Scene Size-Up (1 of 2)
- Scene safety
  - Evaluate every scene for hazards to your health and the health of your team or bystanders.
  - Be prepared with appropriate standard precautions, including gloves, a mask, and eye protection.
  - Call for ALS as soon as possible.

67 Scene Size-Up (2 of 2)
- Mechanism of injury/nature of illness
  - Look for indicators of the MOI.
  - Consider how the MOI produced the injuries expected.

68 Primary Assessment (1 of 10)
- Focus on identifying and managing life-threatening concerns.
  - Threats to circulation, airway, or breathing
  - External hemorrhage
- Reduction of on-scene time and recognition of a critical patient increases the patient’s chances for survival or a reduction in the amount of irreversible damage.
Primary Assessment (2 of 10)

- Spinal immobilization considerations
  - Assess the patient in the position found.
  - Determine whether or not a cervical collar needs to be applied.
  - Assess the scene to determine the risk of injury.
  - Form a general impression based on level of consciousness and chief complaint.

Primary Assessment (3 of 10)

- The backboard often places the patient in an anatomically incorrect position for a long period of time.
  - Circulation to areas of skin may become compromised.
  - Some patients could experience respiratory compromise while lying flat.
  - Try to minimize the amount of time a patient is on a backboard.

Primary Assessment (4 of 10)

- Cervical collar
  - Helps maintain spinal motion restriction
  - The best time to apply the cervical collar depends on the patient’s injuries.
  - Once the cervical collar is on, do not remove it unless it causes a problem with maintaining the airway.

Primary Assessment (5 of 10)

- Assessing for signs and symptoms of a head or spine injury
  - Ask about the chief complaint.
  - Confused or slurred speech, repetitive questioning, or amnesia in responsive patients is a good indication of a head injury.
  - In the setting of trauma, assume your patient has a head injury until your assessment proves otherwise.

Primary Assessment (6 of 10)

- Assessing for signs and symptoms of a head or spine injury (cont’d)
  - If the patient is found unresponsive, emergency responders, family members, or bystanders may have helpful information.
  - Unresponsive trauma patients should be assumed to have a spinal injury.
  - Patients with a decreased level of responsiveness should be considered to have a spinal injury based on their chief complaint.

Primary Assessment (7 of 10)

- Airway, breathing, and circulation considerations
  - Use a jaw-thrust maneuver to open the airway.
  - If the jaw-thrust maneuver is ineffective, use the head tilt–chin lift maneuver as a last resort.
  - Vomiting may occur in the patient with a head injury.
  - Irregular breathing may result from increased ICP.

Primary Assessment (8 of 10)

- Airway, breathing, and circulation considerations (cont’d)
  - Oxygen is always indicated for patients with head and spinal injuries.
– Pulse oximeter values should be maintained above 90%.
– Hyperventilation should be reserved for specific conditions.

76 Primary Assessment (9 of 10)
• Airway, breathing, and circulation considerations (cont’d)
  – A pulse that is too slow in the setting of a head injury can indicate a serious condition.
  – A single episode of hypoperfusion in a patient with a head injury can lead to significant brain damage and even death.
  – Assess for signs and symptoms of shock.
  – Control bleeding.

77 Primary Assessment (10 of 10)
• Manner of transport
  – Patients with impaired airways, open head wounds, or abnormal vital signs may need to be rapidly extracted from a motor vehicle and transported.
  – Providing the patient with a patent airway and supplemental oxygen is paramount.
  – Suction should be readily available.
  – Maintain immobilization of the spine.

78 History Taking
• Investigate the chief complaint.
  – Obtain a medical history and be alert for injury-specific signs and symptoms as well as pertinent negatives.
  – Using OPQRST may provide some background on isolated extremity injuries.
  – Gather as much SAMPLE history as you can while preparing for transport.

79 Secondary Assessment (1 of 7)
• Instruct the patient to keep still and not to move the head or neck.
• Physical examinations
  – May be a systematic head-to-toe, full-body scan or a systematic assessment that focuses on a certain area or region of the body

80 Secondary Assessment (2 of 7)
• Physical examinations (cont’d)
  – Vital signs
    • Significant head injuries may cause the pulse to be slow and the BP to rise.
    • With neurogenic shock, the blood pressure may drop and the heart rate may increase to compensate.
    • Respirations will become erratic.
  – Use monitoring devices.

81 Secondary Assessment (3 of 7)
• Physical examinations (cont’d)
  – Perform a full-body scan using DCAP-BTLS and examine the head, chest, abdomen, extremities, and back.
  – Check perfusion, motor function, and sensation in all extremities prior to moving the patient.

82 Secondary Assessment (4 of 7)
• Physical examinations (cont’d)
  – A decreased level of consciousness is the most reliable sign of a head injury.
  – Look for leaking blood or CSF.
- Assess pupil size and reaction to light and continue to monitor the pupils.
- Do not probe open scalp lacerations with your gloved finger.

Secondary Assessment (5 of 7)
- Neurologic examination
  - Perform baseline assessment using the Glasgow Coma Scale (GCS).
  - Always use simple, easily understood terms when reporting the level of consciousness.
  - Record levels of consciousness that fluctuate or deteriorate.

Secondary Assessment (6 of 7)

Secondary Assessment (7 of 7)
- Spine examination
  - Inspect for DCAP-BTLS and check the extremities for circulation, motor, or sensory problems.
  - If there is impairment, note the level.
  - Pain or tenderness when you palpate the spinal area is a warning sign.
  - Other signs and symptoms include deformity; numbness, weakness, or tingling in the extremities; and soft-tissue injuries.

Reassessment (1 of 4)
- Repeat the primary assessment.
- Reassess vital signs and the chief complaint.
- Recheck patient interventions.
  - These injuries can suddenly affect the respiratory, circulatory, and nervous systems.
  - Reassess at least every 5 minutes.

Reassessment (2 of 4)
- Interventions
  - Multiple interventions may be necessary in patients with head and spinal injuries.
  - Compare baseline vital signs with repeated vital signs; changes will often tell you if treatments have been effective.
  - You will notice deterioration in a conscious patient's awareness of time, place, and person (self), in that order.

Reassessment (3 of 4)
- Interventions (cont'd)
  - You must act quickly to evaluate and treat these patients.
  - If CSF is present, cover the wound with sterile gauze, but do not bandage tightly.
  - Administer high-flow oxygen and apply a cervical collar.

Reassessment (4 of 4)
- Communication and documentation
  - Your documentation should include:
    - The history you obtained at the scene
    - Your findings during your assessment
    - Treatments you provided
    - How the patient responded to them
  - Document vital signs for unstable patients every 5 minutes; every 15 for stable patients
Emergency Medical Care of Head Injuries (1 of 7)

- Three general principles:
  - Establish an adequate airway.
  - Control bleeding and provide adequate circulation to maintain cerebral perfusion.
  - Begin CPR, if necessary.
  - Follow standard precautions.
  - Assess the patient's baseline level of consciousness, and continuously monitor.

Emergency Medical Care of Head Injuries (2 of 7)

- Managing the airway
  - The most important steps is establishing an adequate airway.
  - Perform the jaw-thrust maneuver.
  - Once the airway is open, maintain the head and cervical spine in a neutral, in-line position until you have placed a cervical collar and have secured the patient on a backboard.

Emergency Medical Care of Head Injuries (3 of 7)

- Managing the airway (cont’d)
  - Remove any foreign bodies, secretions, or vomitus.
  - Make sure a suctioning unit is available.
  - Check ventilation.
  - Give supplemental oxygen to any patient with suspected head injury.

Emergency Medical Care of Head Injuries (4 of 7)

- Circulation
  - Begin CPR if the patient is in cardiac arrest.
  - Active blood loss aggravates hypoxia.
  - You can almost always control bleeding from a scalp laceration by applying direct pressure over the wound.

Emergency Medical Care of Head Injuries (5 of 7)

- Shock is usually the result of hypovolemia.
  - Indicates that the situation is critical
  - Transport immediately to a trauma center.

Emergency Medical Care of Head Injuries (6 of 7)

- Cushing’s triad
  - Increased blood pressure (hypertension)
  - Decreased heart rate (bradycardia)
  - Irregular respirations (Cheyne-Stokes respirations or Biot respirations)
  - Perform controlled hyperventilation of your patient via positive-pressure ventilations at a rate of 20 breaths/min.

Emergency Medical Care of Spinal Injuries (1 of 6)

- Follow standard precautions.
- Maintain the patient’s airway while keeping the spine in the proper position.
- Assess respirations and give supplemental oxygen.

Emergency Medical Care of Spinal Injuries (2 of 6)
• Managing the airway
  – Perform the jaw-thrust maneuver.
  – After you open the airway, consider inserting an oropharyngeal airway.
  – Have a suctioning unit available.
  – Provide supplemental oxygen.

Emergency Medical Care of Spinal Injuries (3 of 6)

Emergency Medical Care of Spinal Injuries (4 of 6)

• Immobilization of the cervical spine
  – Immobilize the head and trunk so that bone fragments do not cause further damage.
  – Never force the head into a neutral, in-line position.
  – Immobilize the patient in his or her current position.

Emergency Medical Care of Spinal Injuries (5 of 6)

• Cervical collars
  – Provide preliminary, partial support
  – Should be applied to every patient who has a possible spinal injury
  – To be effective, a rigid cervical collar must be the correct size.

Emergency Medical Care of Spinal Injuries (6 of 6)

• Cervical collars (cont’d)
  – The cervical collar should rest on the shoulder girdle and provide firm support under both sides of the mandible, without obstructing the airway or ventilation.
  – Once the patient’s head and neck have been manually stabilized, assess the pulse, motor functions, and sensation in all extremities. Then assess the cervical spine area and neck.

Preparation for Transport (1 of 7)

• Supine patients
  – Secure to a long backboard or vacuum mattress.
  – Another procedure to move a patient from the ground to a backboard is the four-person log roll.
  – You may also slide the patient onto a backboard or vacuum mattress.

Preparation for Transport (2 of 7)

• Vacuum mattress
  – An alternative to the long backboard is a vacuum mattress.
  – Molds to the specific contours of patient’s body
  – Excellent for the elderly or a patient with abnormal curvature of the spine
  – Can be used on a supine, sitting, or standing patient

Preparation for Transport (3 of 7)

• Sitting patients
  – Use a short backboard to restrict movement of the cervical and thoracic spine.
  – Then secure the short board to the long board.
  – Exceptions include situations in which:
    • You or the patient is in danger
    • You need immediate access to other patients
    • The patient’s injuries justify urgent removal
Preparation for Transport (4 of 7)

• Standing patients
  – Immobilize the patient to a long backboard before proceeding with assessment.
  – Establish manual, in-line stabilization and apply a cervical collar.
  – Position the board upright directly behind the patient.
  – Carefully lower the patient as a unit under the direction of the EMT at the head.

Preparation for Transport (5 of 7)

• Spinal immobilization devices
  – Assume the presence of spinal injury in all patients who have sustained head injuries.
  – Use manual in-line stabilization or a cervical collar and long backboard

Preparation for Transport (6 of 7)

• Short backboards
  – Vest-type device and rigid short board
  – Designed to immobilize and restrict movement of the head, neck, and torso
  – Used to immobilize noncritical patients found in a sitting position

Preparation for Transport (7 of 7)

• Long backboards
  – Provide full body spinal immobilization and motion restriction to the head, neck, torso, pelvis, and extremities
  – Used to immobilize patients found in any position

Helmet Removal (1 of 6)

• A helmet that fits well prevents the patient’s head from moving and should be left on, provided:
  – There are no impending airway or breathing problems.
  – It does not interfere with assessment and treatment of airway or ventilation problems.
  – You can properly immobilize the spine.

Helmet Removal (2 of 6)

• Remove a helmet if:
  – It is a full-face helmet.
  – It makes assessing or managing airway problems difficult.
  – It prevents you from properly immobilizing the spine.
  – It allows excessive head movement.
  – The patient is in cardiac arrest.

Helmet Removal (3 of 6)

• Preferred method
  – Removing a helmet should always be at least a two-person job.
  – You should first consult with medical control about your decision to remove a helmet.

Helmet Removal (4 of 6)

• Alternate method
  – The advantage is that it allows the helmet to be removed with the application of less force, therefore reducing the likelihood of motion occurring in the neck.
  – The disadvantage is that it is slightly more time consuming.
Helmet Removal (5 of 6)

• Alternate method (cont’d)
  – Remove the chin strap.
  – Remove the face mask.
  – Pop the jaw pads out of place.
  – Place your fingers inside the helmet.
  – Hold the jaw with one hand and the occiput with the other.
  – Insert padding behind the occiput.

Helmet Removal (6 of 6)

• Alternate method (cont’d)
  – The person at the side of the patient’s chest is responsible for making sure that the head and neck do not move during removal of the helmet.
  – Remember that children may require additional padding to maintain the in-line neutral position.

Review

1. The brain, a part of the central nervous system (CNS), is divided into the:
   A. cerebrum, cerebellum, and brain stem.
   B. cerebrum, brain stem, and spinal cord.
   C. cerebellum, cerebrum, and spinal cord.
   D. spinal cord, cerebrum, and cerebral cortex.

Review

Answer: A
Rationale: The brain and spinal cord comprise the central nervous system (CNS). The brain is divided into three major regions: the cerebrum (the largest portion), the cerebellum, and the brain stem. Each region of the brain carries out specific functions.

Review (1 of 2)

1. The brain, a part of the central nervous system (CNS), is divided into the:
   A. cerebrum, cerebellum, and brain stem.
   Rationale: Correct answer
   B. cerebrum, brain stem, and spinal cord.
   Rationale: The spinal cord is not part of the brain.

Review (2 of 2)

1. The brain, a part of the central nervous system (CNS), is divided into the:
   C. cerebellum, cerebrum, and spinal cord.
   Rationale: The spinal cord is not part of the brain.
   D. spinal cord, cerebrum, and cerebral cortex.
   Rationale: The spinal cord is not part of the brain.

Review

2. As you are assessing a 24-year-old man with a large laceration to the top of his head, you should recall that:
   A. the scalp, unlike other parts of the body, has relatively fewer blood vessels.
   B. blood loss from a scalp laceration may contribute to hypovolemic shock in adults.
   C. any avulsed portions of the scalp should be carefully cut away to facilitate bandaging.
   D. most scalp injuries are superficial and are rarely associated with more serious injuries.
Answer: B
Rationale: Although the scalp is highly vascular and tends to bleed heavily when injured, scalp injuries are rarely the sole cause of hypovolemic shock in adults. However, they can contribute to hypovolemic shock caused by injuries elsewhere in the body. Scalp lacerations, whether deep or superficial, should prompt you to look for more serious underlying injuries, such as a skull fracture. If the injury involves an avulsion, the avulsed flap of skin should be carefully replaced to its original position, not cut away.

Review (1 of 2)
2. As you are assessing a 24-year-old man with a large laceration to the top of his head, you should recall that:
   A. the scalp, unlike other parts of the body, has relatively fewer blood vessels.
      Rationale: The scalp is highly vascular.
   B. blood loss from a scalp laceration may contribute to hypovolemic shock in adults.
      Rationale: Correct answer

Review (2 of 2)
2. As you are assessing a 24-year-old man with a large laceration to the top of his head, you should recall that:
   C. any avulsed portions of the scalp should be carefully cut away to facilitate bandaging.
      Rationale: The avulsed flap should be carefully replaced to its original position.
   D. most scalp injuries are superficial and are rarely associated with more serious injuries.
      Rationale: Deep or superficial scalp lacerations should prompt EMS providers to assess for more serious underlying injuries.

Review
3. A patient who experiences an immediate loss of consciousness followed by a lucid interval has a(n):
   A. epidural hematoma.
   B. subdural hematoma.
   C. concussion.
   D. contusion.

Review
Answer: A
Rationale: Epidural hematomas are caused by injury to an artery—usually the middle meningeal artery—that lies in between the skull and brain. Patients with an epidural hematoma typically experience an immediate loss of consciousness followed by a brief period of consciousness (lucid interval) as intracranial pressure increases. Subdural hematomas are the result of injury to a vein; therefore, they tend to bleed slowly and usually cause a progressive decline in level of consciousness. Concussions and contusions may cause a loss of consciousness, but it is typically brief.

Review (1 of 2)
3. A patient who experiences an immediate loss of consciousness followed by a lucid interval has a(n):
   A. epidural hematoma.
      Rationale: Correct answer
   B. subdural hematoma.
      Rationale: Subdural hematomas tend to bleed slowly and usually cause a progressive decline in the level of consciousness.

Review (2 of 2)
3. A patient who experiences an immediate loss of consciousness followed by a lucid interval has a(n):
   C. concussion.
   Rationale: Concussions may cause a loss of consciousness, but is typically brief.
   D. contusion.
   Rationale: Contusions may cause a loss of consciousness, but is typically brief.

4. A 44-year-old man was struck in the back of the head and was reportedly unconscious for approximately 30 seconds. He complains of a severe headache and "seeing stars," and states that he regained his memory shortly before your arrival. His presentation is MOST consistent with a(n):
   A. contusion.
   B. concussion.
   C. subdural hematoma.
   D. intracerebral hemorrhage.

Answer: B
Rationale: A concussion occurs when the brain is jarred around inside the skull. It may result in a brief loss of consciousness and occasionally, amnesia. Seeing stars is a common finding following trauma to the back of the head (occiput), as this region is primarily responsible for vision. A concussion—the least severe of all closed head injuries—typically does not result in physical damage to the brain. Compared to a concussion, a contusion, subdural hematoma, and intracerebral hemorrhage are usually associated with a more prolonged loss of consciousness.

5. A young male was involved in a motor vehicle accident and experienced a closed head
injury. He has no memory of the events leading up to the accident, but remembers that he was going to a birthday party. What is the correct term to use when documenting his memory loss?

A. Concussion
B. Cerebral contusion
C. Retrograde amnesia
D. Anterograde amnesia

Review
Answer: C
Rationale: The term amnesia means loss of memory; it is common in patients who have experienced a cerebral concussion. Amnesia of events leading up to an injury is called retrograde amnesia. Anterograde amnesia—also called posttraumatic amnesia—is the inability to remember events that occurred—or will occur—after the injury.

Review (1 of 2)
5. A young male was involved in a motor-vehicle accident and experienced a closed head injury. He has no memory of the events leading up to the accident, but remembers that he was going to a birthday party. What is the correct term to use when documenting his memory loss?

A. Concussion
   Rationale: This occurs when the brain is jarred inside the skull.
B. Cerebral contusion
   Rationale: This is when tissue is bruised and damaged in a local area. It may result in prolonged confusion.
C. Retrograde amnesia
   Rationale: Correct answer
D. Anterograde amnesia
   Rationale: This is the loss of memory relating to events that occurred after the injury.

Review
6. A distraction injury to the cervical spine would MOST likely occur following:
   A. a diving accident.
   B. blunt neck trauma.
   C. hyperextension of the neck.
   D. hanging-type mechanisms.

Review
Answer: D
Rationale: Excessive traction on the neck, such as what occurs during hanging-type mechanisms, can cause a distraction injury of the cervical spine. Distraction injuries can cause separation of the vertebrae and stretching or tearing of the spinal cord.

Review (1 of 2)
6. A distraction injury to the cervical spine would MOST likely occur following:
   A. a diving accident.
   Rationale: This would possibly cause a compression injury.
B. blunt neck trauma.
   Rationale: This can result in a fracture or neurologic deficit.

Review (2 of 2)
6. A distraction injury to the cervical spine would MOST likely occur following:
   C. hyperextension of the neck.
      Rationale: This can result in a fracture or neurologic deficit.
   D. hanging-type mechanisms.
      Rationale: Correct answer

Review
7. During immobilization of a patient with a possible spinal injury, manual stabilization of the head must be maintained until:
   A. an appropriate-size extrication collar has been placed.
   B. the patient is fully immobilized on a long backboard.
   C. a range of motion test of the neck has been completed.
   D. pulse, motor, and sensory functions are found to be intact.

Answer: B
Rationale: Manual stabilization of the patient’s head must be maintained until he or she is fully secured to the long backboard. This includes the application of an extrication collar, straps, and lateral immobilization (head blocks). Pulse, motor, and sensory functions must be checked before and after the immobilization process. Do not assess range of motion in a patient with a possible spinal injury; this involves moving the patient’s neck and may cause further injury.

Review (1 of 2)
7. During immobilization of a patient with a possible spinal injury, manual stabilization of the head must be maintained until:
   A. an appropriate-size extrication collar has been placed.
      Rationale: This is only one small part of the total immobilization process.
   B. the patient is fully immobilized on a long backboard.
      Rationale: Correct answer

Review (2 of 2)
7. During immobilization of a patient with a possible spinal injury, manual stabilization of the head must be maintained until:
   C. a range of motion test of the neck has been completed.
      Rationale: Do not assess the range of motion in a patient with a possible spinal injury.
   D. pulse, motor, and sensory functions are found to be intact.
      Rationale: This is done before and after complete immobilization.

Review
8. Your patient is a 21-year-old male who has massive face and head trauma after being assaulted. He is lying supine, is semiconscious, and has blood in his mouth. You should:
   A. insert a nasal airway, assess his respirations, and give 100% oxygen.
   B. suction his airway and apply high-flow oxygen via a nonrebreathing mask.
   C. manually stabilize his head, log roll him onto his side, and suction his mouth.
   D. apply a cervical collar, suction his airway, and begin assisting his ventilations.

Answer: C
Rationale: Blood or other secretions in the mouth place the airway in immediate jeopardy and must be removed before they are aspirated. At the same time, you must protect the patient’s spine due to the mechanism of injury. Therefore, you should manually stabilize the patient’s head, log roll him onto his side (allows drainage of blood from his mouth), and suction his mouth for up to 15 seconds. After ensuring that his airway is clear, assess his breathing and give high-flow oxygen or assist his ventilations. Nasal airways should not be used in patients with severe facial or head trauma.

Review (1 of 2)
8. Your patient is a 21-year-old male who has massive face and head trauma after being assaulted. He is lying supine, is semiconscious, and has blood in his mouth. You should:
   A. insert a nasal airway, assess his respirations, and give 100% oxygen.
      Rationale: Nasal airways should not be used in patients with severe facial or head trauma or with suspected fractures.
   B. suction his airway and apply high-flow oxygen via a nonrebreathing mask.
      Rationale: This must be done after manual stabilization of the spine and rolling the patient to his side.

Review (2 of 2)
8. Your patient is a 21-year-old male who has massive face and head trauma after being assaulted. He is lying supine, is semiconscious, and has blood in his mouth. You should:
   C. manually stabilize his head, log roll him onto his side, and suction his mouth.
      Rationale: Correct answer
   D. apply a cervical collar, suction his airway, and begin assisting his ventilations.
      Rationale: The cervical collar should be applied but manual stabilization must take place first. There are no indications here that the patient’s rate of respirations are inadequate and require assisted ventilations.

Review
9. A man is found slumped over the steering wheel, unconscious and making snoring sounds, after an automobile accident. His head is turned to the side and his neck is flexed. You should:
   A. gently rotate his head to correct the deformity.
   B. carefully hyperextend his neck to open his airway.
   C. apply an extrication collar with his head in the position found.
   D. manually stabilize his head and move it to a neutral, in-line position.

Review
Answer: D
Rationale: The patient's snoring sounds indicate an airway problem, which must be corrected or he may die. Manually stabilize his head; carefully move it to a neutral, in-line position; and reassess his breathing. Do not rotate or hyperextend the neck of a patient with a possible spinal injury; the results could be disastrous.

Review (1 of 2)
9. A man is found slumped over the steering wheel, unconscious and making snoring sounds, after an automobile accident. His head is turned to the side and his neck is flexed. You should:
   A. gently rotate his head to correct the deformity.
      Rationale: Do not hyperextend the neck of a patient with a possible spinal injury.
   B. carefully hyperextend his neck to open his airway.
      Rationale: Do not hyperextend the neck of a patient with a possible spinal injury.
9. A man is found slumped over the steering wheel, unconscious and making snoring sounds, after an automobile accident. His head is turned to the side and his neck is flexed. You should:
   C. apply an extrication collar with his head in the position found. 
   Rationale: The head must be placed in a neutral position to open the airway.
   D. manually stabilize his head and move it to a neutral, in-line position. 
   Rationale: Correct answer

10. You should NOT remove an injured football player’s helmet if:
   A. a cervical spine injury is suspected, even if the helmet fits loosely.
   B. the patient has a patent airway, even if he has breathing difficulty.
   C. he has broken teeth, but only if the helmet does not fit snugly in place.
   D. the face guard can easily be removed and there is no airway compromise.

Answer: D

Rationale: In general, you should leave a helmet on if it fits snugly and does not allow movement of the head within the helmet, the patient’s airway is patent, no airway problems are anticipated, and the patient is breathing without difficulty. If you can easily remove the face guard (often the case with football helmets) and there are no airway problems, do so but leave the helmet on. If the helmet is loose, the airway is in anyway compromised, or the patient has difficulty breathing or is in cardiac arrest, the helmet must be removed.

10. You should NOT remove an injured football player’s helmet if:
   A. a cervical spine injury is suspected, even if the helmet fits loosely.
   Rationale: If the helmet allows for movement of the head, it should be removed.
   B. the patient has a patent airway, even if he has breathing difficulty.
   Rationale: The helmet must be removed if the patient is having breathing difficulty.

10. You should NOT remove an injured football player’s helmet if:
   C. he has broken teeth, but only if the helmet does not fit snugly in place.
   Rationale: Broken teeth present a potential for airway obstruction.
   D. the face guard can easily be removed and there is no airway compromise.
   Rationale: Correct answer