Caring for patients with spinal cord injuries

Learn how to help stabilize patients and prevent complications of these devastating injuries.

By Mark Bauman, MS, RN, CCRN, and Tammy Russo-McCourt, BSN, RN, CCRN

Spinal cord injuries (SCIs) are a significant cause of disability, with profound—and in many cases devastating—consequences. According to recent data, about 12,000 SCIs occur annually in the United States, and up to 250,000 Americans are living with SCIs. Most victims are aged 16 to 30; more than 80% are males. In both genders, motor vehicle accidents, falls, and gunshot wounds account for most SCIs; in persons aged 65 and older, falls are the leading cause. The Centers for Disease Control and Prevention estimates that SCI-related medical costs amount to about $9.7 billion each year. (See *Serious and deadly complications of SCI.*)

Most SCIs result from direct trauma to the vertebral column, affecting the spinal cord's ability to send and receive messages to and from the brain. The disruption impairs the systems that control sensory, motor, and autonomic functions below the injury level.

This article differentiates the types of SCIs and describes clinical and diagnostic evaluation, treatment, and nursing care for patients with SCIs. It assumes readers have a basic understanding of spinal cord anatomy and physiology.

Types of SCIs

A complete SCI causes total loss of all motor and sensory function below the injury level, including the lowest sacral segments. Complete cord transection is rare. Function loss usually stems from a contusion or compromised blood flow to the injured part of the cord, as from subluxation and hyperflexion or extension injury.

With an incomplete SCI, patients retain some level of sensory function, motor function, or both below the injury level. They may be able to move one arm or leg more than the other or may have greater motor or sensory function on one side of the body. Incomplete SCIs fall into several categories. (See *Types of incomplete SCIs.*

Clinical evaluation

Signs and symptoms of SCI include:

- extreme pain or pressure in the neck, head, or back
- tingling or sensation loss in the hands, fingers, feet, or toes
- partial or complete loss of control over any body part
- urinary or bowel urgency, incontinence, or retention
- difficulty with balance and walking
- impaired breathing
- abnormal bandlike sensations in the thorax, with pain and pressure
- unusual lumps on the head or spine.

SCI may be ruled out by checking for criteria from the National Emergency X-Radiography Utilization Study. (See *NEXUS criteria to exclude SCI.*)

Patients with a suspected SCI must undergo a thorough examination using a validated assessment tool, such as the International Standards for Neurological Classification of Spinal Cord Injury from the American Spinal Injury Association (ASIA) examination. This tool promotes appropriate evaluation of motor and sensory function and classifies the degree of impairment as complete (type A) or incomplete (types B through E). To learn more about ASIA and access its resources, visit asia-spinalinjury.org and elearnsci.org.

Radiologic evaluation

Best practices for SCI evaluation include use of computerized tomography (CT) when available. The American Association of Neurological Surgeons/Congress of Neurological Surgeons 2013 Joint Guidelines for the Management of Acute Cervical Spine and Spinal Cord Injury recommend traditional X-rays only if high-quality CT isn't available. For patients with known or suspected SCIs, magnetic resonance imaging helps visualizes the spinal cord and detects ligamentous injury, blood

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Learning Objectives

1. Differentiate the types of spinal cord injuries (SCIs).
2. Describe the evaluation of patients with SCIs.
3. Discuss treatment of patients with SCIs.

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clots, and herniated discs or other masses that may be compressing the cord. Providers should follow their facility's spinal-clearance protocols for SCI detection.

Treatment

Treatment begins even before the patient is admitted. Paramedics or other emergency medical services personnel carefully immobilize the spine at the scene. In the emergency department (ED), immobilization continues while the healthcare team identifies and addresses more immediate life-threatening problems. If the patient needs emergency surgery for trauma to the abdomen, chest, or other area, immobilization and alignment must be maintained during the operation.

For many CSI patients, traction may be indicated to help bring the spine into proper alignment and restore blood flow to the injured area. Occasionally, a surgeon may take the patient to the operating room immediately if the cord appears to be compressed by a herniated disc, blood clot, or other lesion. This most often happens with an incomplete SCI or progressive neurologic deterioration. Even if surgery can't reverse spinal cord damage, it may be needed to stabilize the spine to prevent future pain or deformity.

Nursing care

Nursing care can prevent or mitigate further injury and promote the best possible patient outcome. Focus your care on:

- maintaining stable blood pressure (BP)
- monitoring cardiovascular function
- ensuring adequate ventilation and lung function
- preventing and promptly addressing infection and other complications.

Use serial SCI assessments with a consistent grading tool to monitor and communicate motor and sensory improvement or deterioration, including reflexes, deep tendon function, and rectal tone. Be sure to establish baseline findings and perform serial assessments—usually hourly or more often during the initial injury phase and less often as the injury stabilizes. Conduct additional assessments and document findings each time the patient has been moved out of bed (for instance, for diagnostic tests) or if you suspect deterioration.

Establishing a baseline helps caregivers promptly detect improvement or deterioration. Assessment should be interprofessional, involving the provider, nurse, and physical therapist.

Always logroll the patient to check for rectal tone as well as when repositioning, toileting, and performing skin care or chest physiotherapy (CPT). (See *Quick guide to nursing care for SCI patients.*)

Respiratory management

Respiratory impairment is the most common complication of acute SCI. The extent of impairment depends on injury level and severity. Take all possible measures to protect the patient's airway and maintain adequate respiration. High thoracic to cervical SCIs put the patient at risk for respiratory insufficiency. Lower spinal injuries have minimal consequences for motor function of the respiratory muscles.

Closely monitor the patient's respiratory rate, depth, and pattern, staying alert for paradoxical breathing. Also monitor breath sounds, cough strength and effectiveness, gas exchange adequacy, and arterial blood gas (ABG) results. Maintain continuous pulse oximetry; when possible, use end-tidal capnography as part of routine monitoring.

Help the patient use incentive spirometry to monitor inspiratory lung volumes. Vital capacity below 1 L suggests decreased inspiratory muscle strength, which may result in atelectasis and, over time, respiratory fatigue and failure. A weak or ineffective cough may lead to retained secretions and subsequent pneumonia.

As indicated and ordered, provide adjunctive treatments, including CPT and postural drainage, suctioning, bronchoscopy, intrapulmonary percussive ventilation (IPV) with aerosolized mucolytics and bronchodilators, and mechanical cough assist to help mobilize and clear secretions. An abdominal binder placed below the costal margin to support the viscera can aid breathing by bringing the diaphragm into a better resting position.

Intubation. Patients with respiratory failure require mechanical ventilation. If your patient needs intu-

Serious and deadly complications of SCI

Patients with tetraplegia—a neurologically complete cervical spinal cord injury (SCI)—are at lifelong high risk for secondary medical complications. Pressure ulcers are the most common complications. In the first year after injury, 15% of tetraplegic patients develop them; incidence rises steadily thereafter. The most common ulcer location is the sacrum. Other complications of tetraplegia include pneumonia and deep vein thrombosis.

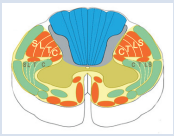
Several factors influence mortality in patients with SCI. Perhaps the most significant is severity of associated injuries. Due to the force needed to fracture the spine, significant damage to the chest or abdomen may accompany SCIs, with potentially fatal consequences. In general, younger patients and those with incomplete SCIs have a better prognosis than older patients and those with tetraplegia.

Respiratory diseases are the leading cause of death in SCI patients, with pneumonia accounting for 71% of these deaths. The second and third leading causes are heart disease and infections, respectively. The cumulative 20-year survival rate for SCI patients is 70.6%, but given underreporting and cases lost in follow-up, the actual death rate is probably higher.

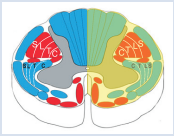
Types of incomplete SCIs

An incomplete spinal cord injury (SCI) leaves the patient with some motor or sensory function below the injury level. Most incomplete SCIs fall into the following categories.

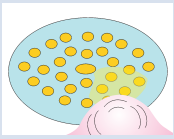
Anterior cord syndrome: The most common incomplete SCI, anterior cord syndrome usually stems from impact trauma with compression and ischemia to the motor and sensory pathways in the anterior parts of the cord. Although patients may feel gross sensation via intact pathways in the posterior part of the cord, they lose movement and fine sensation.



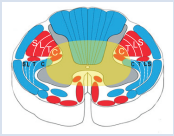
Brown-Sequard syndrome: This rare disorder results from injury to one side of the spinal cord, usually by direct insult to the spine, such as a penetrating injury. The defining characteristic is loss of pain and temperature sensation on the side opposite the injury, because these pathways cross to the opposite side shortly after entering the spinal cord. The patient loses movement and some types of sensation below the injury level on the injured side.



Cauda equina syndrome: This progressive neurologic syndrome results from injury to the cauda equina, a bundle of nerve roots arising from the end of the spinal cord. It's marked by lumbar pain, weakness or paralysis of the lower extremities (which may be asymmetrical), saddle anesthesia, and bowel and bladder incontinence. The most common cause of cauda equina syndrome is significant disc herniation.



Central cord syndrome: Usually caused by trauma, central cord syndrome is linked to damage to the large nerve fibers that carry information directly from the cerebral cortex to the cord. Signs and symptoms may include paralysis and loss of fine control of arm and hand movements, with far less impairment of leg movement. Sensory loss below the SCI site and loss of bladder control also may occur.



Conus medullaris syndrome: This condition stems from injury to the conus medullaris, the terminal end of the spinal cord. Patients typically present with sudden onset of lower back pain, bowel and bladder dysfunction, and symmetrical motor and sensory dysfunction. Distinguishing this syndrome from cauda equina syndrome may be difficult.

bation, take care to maintain spinal alignment by using a cervical collar, manual inline traction, or both.

Be sure to initiate the ventilator bundle for these patients. The Institute for Healthcare Improvement's ventilator bundle includes five components of care:

- at least 30-degree elevation of the head of the bed
- daily sedation interruption and assessment for readiness to extubate
- oral care with chlorhexidine
- peptic ulcer disease prophylaxis
- deep vein thrombosis (DVT) prophylaxis.

Many patients with injuries at the C3 vertebral level or higher are ventilator dependent. Those with an intact phrenic nerve may qualify for diaphragmatic pacer implantation, which may allow weaning from mechanical ventilation.

Cardiovascular management

Patients with significant cervical and high thoracic injuries (T6 level and above) may develop neurogenic shock. Caused by loss of sympathetic tone, this distributive shock state results in vasodilation, profound bradycardia, and hypothermia. Hypotension, temperature dysregulation, venous stasis, and autonomic dysregulation (AD) may occur.

Hypotension. Hypotension predisposes the acute SCI patient to a secondary injury from reduced blood flow and poor spinal cord perfusion, possibly worsening neurologic outcome. Be sure to maintain continuous heart rate and BP monitoring.

Expect to manage hypotension with volume resuscitation and vasopressor therapy. The goal of therapy is to sustain a mean arterial pressure (MAP) of 85 mm Hg or higher for 7 days (an approach called hemodynamic push), which studies suggest may improve neurologic outcomes.

Once the patient is cleared for mobilization, neurogenic orthostatic hypotension may occur. Such strategies as abdominal binder application, compression stockings, compression wrappings for the lower extremities, and slow elevation of the head of the bed may help reduce this risk.

In patients whose hypotension persists despite these interventions, midodrine, pseudoephedrine, and salt tablets have been shown to have some effect, such as increased heart rate and BP. Small studies suggest droxidopa also may raise BP.

Typically, patients adapt to a lower BP over time; some may experience bradycardia from unopposed vagal flow. Vasopressors that raise the heart rate may offer some benefit during the initial hemodynamic push. Such medications as enteral albuterol have been used to increase the heart rate in patients with persistent symptomatic bradycardia.

Stimulation of the vasovagal reflex may lead to cardiac arrest, requiring emergency atropine administration. To help prevent asystole episodes, hyperoxygenate the patient before turning or suctioning

(unless contraindicated). Cardiac pacing has been used in patients whose hypotension fails to resolve over time or who require frequent doses of anticholinergic drugs.

Temperature dysregulation. Inability to sweat or shiver (poikilothermia) affects the patient's temperature regulation and can worsen bradycardia. Poikilothermia is more likely to occur with higher-level SCIs and more complete motor impairment. Monitor environmental temperature, as this can affect body temperature. Hypothermia may worsen bradycardia and hypotension. Provide gentle rewarming and monitor core temperature continuously.

Venous stasis. DVT and subsequent venous thromboembolism are serious threats. In SCI, loss of vascular and muscle tone causes venous stasis. Coupled with immobility and initiation of the clotting cascade (caused by trauma), venous stasis puts patients at high risk for blood clots—a risk that remains high for up to 3 months after the injury.

Venous stasis prophylaxis includes immediate application of pneumatic compression sleeves, along with subtherapeutic heparin or enoxaparin initiated 72 hours after the injury, once the bleeding risk resolves. In cases of blood clot formation, the patient may receive an implantable filter in addition to conventional anticoagulant therapy.

AD. This condition may arise when spinal shock starts to resolve and reflexes return. A stimulus (typically a noxious one) activates the spinal reflex mechanism, causing vasoconstriction below the injury level, which in turn causes BP to rise. Injuries at the T6 level and higher involve the splanchnic vascular bed, resulting in a "visceral squeeze," which further increases BP and boosts venous return to the heart. Baroreceptors in the carotid arteries and aortic arch detect the critical rise in BP and send signals to the brainstem, which responds by sending messages via the parasympathetic nervous system to induce vasodilation and slow the heart rate. Unfortunately, those messages can't descend below the injury level to disrupt vasoconstriction. As a result, pallor develops below the injury level while flushing, sweating, and pounding headache occur above it.

Many patients with higher-level SCIs have a lower baseline BP. If they have what's commonly defined as a "normal" BP, this actually may represent early AD. In some cases, elevated BP reaches levels of clinical emergency. Use rapid interventions, such as sitting the patient upright to induce orthostasis (if possible) and administering fast-acting antihypertensive agents (such as nifedipine) if ordered, to lower BP as the offending stimulus is identified and eliminated. The most common culprits in AD are a full bowel and distended bladder.

GI management

Acute GI problems in SCI patients may include paralytic ileus with associated abdominal distention, gastric ulcers, and constipation. While the exact mechanism is unclear, some experts believe ileus stems from loss of balance between branches of the autonomic nervous system. Ileus typically resolves within the first week after injury.

Monitor the patient's bowel sounds and abdominal distention at least every 4 hours. If indicated and ordered, insert a decompressive gastric tube to reduce aspiration risk and restore diaphragm position and lung size to normal.

The injury level determines whether the patient has a neurogenic (upper motor neuron) or aneurogenic (lower motor neuron) bowel.

- *Neurogenic* bowel is marked by loss of voluntary control of the external rectal sphincter, tight reflexive sphincter tone, retained stool, and constipation. To aid bowel regulation, the patient may need a bowel regimen of stool softeners and a high-fiber diet along with low-volume enemas, glycerin, or bisacodyl suppositories or digital rectal stimulation to cause reflexive evacuation after the morning meal. (Gastric distention activates

NEXUS criteria to exclude SCI

To rule out cervical spine injury in low-risk patients and eliminate the need for further cervical imaging or cervical spine stabilization after blunt trauma, clinicians can use these criteria from the National Emergency X-Radiography Utilization Group (NEXUS):

- no posterior midline cervical spine tenderness
- no evidence of intoxication
- normal alertness level
- no focal neurologic deficit
- no painful distracting injury.

NSAID mnemonic

To remember these criteria, you can use the "NSAID" mnemonic below. But keep in mind that "NSAID" refers to ***absence*** of NEXUS criteria. Thus, cervical spine injury ***can't*** be ruled out in a patient who has any of the findings below.

N Neuro deficit
S Spinal tenderness (midline)
A Altered mental status (normal level of consciousness)
I Intoxication (alcohol or drugs)
D Distracting injuries

In patients who complain of neck pain, aren't fully awake, or have obvious weakness or other signs or symptoms of neurologic injury, keep the cervical spine in a rigid collar until appropriate radiologic studies are completed.

Quick guide to nursing care for SCI patients

The nursing interventions below can help promote optimal outcomes in patients with spinal cord injury (SCI).

Body system	Potential problem	Nursing intervention
Respiratory	• Respiratory insufficiency, failure, or both	• Monitor respirations for signs of fatigue and impending failure. • Provide pulmonary toileting. • Administer bronchodilators, as ordered.
Cardiovascular	• Acute hypotension	• Maintain mean arterial pressure > 85 mm Hg for first 7 days after injury.
	• Bradycardia	• Monitor heart rate • Administer medications for symptomatic bradycardia, as ordered.
	• Poikilothermia	• Maintain normothermia.
	• Deep vein thrombosis (DVT)	• Minimize DVT risk. • Initiate prophylaxis.
	• Orthostatic hypotension	• Monitor for orthostatic hypotension.
	• Autonomic dysreflexia (AD)	• Monitor for signs and symptoms of AD.
Genitourinary	• Urinary retention	• Decompress bladder via indwelling catheter insertion, as ordered. • Implement intermittent straight catheterization protocol when appropriate.
GI	• Ileus	• Monitor for abdominal distention.
	• Constipation	• Maintain bowel elimination.
Musculoskeletal	• Contractures	• Provide frequent range-of-motion exercises. • Administer antispasmodics, as ordered.
Dermatologic	• Skin breakdown	• Perform meticulous skin care, frequently observing under splints and braces. • Reposition patient every 2 hours in bed. • Shift weight every 30 minutes when patient is out of bed in upright wheelchair.

bowel motility.) To reduce the risk of constipation-induced AD, perform a digital check of the rectum for retained stool.

- In *aneurogenic* bowel, patients have a slow colonic transport time and lose both voluntary control and reflexive sphincter tone. Fecal incontinence is common. Stool softeners, mini-enemas, and digital stool removal may keep the rectum empty, reducing incontinence frequency.

Genitourinary management

A patient in neurogenic shock experiences abrupt loss of voluntary muscle control and reflexes, resulting in acute urinary retention. An indwelling urinary catheter must be placed to decompress the bladder and allow close urinary output monitoring during the initial resuscitation and critical management phases. The patient may need the catheter for the duration of the hemodynamic push period to prevent bladder distention and bladder injury. During the acute phase, fluid shifts may result from I.V. fluid administration coupled with use of vasopressors to support blood pressure. The catheter stays place until the patient achieves hemodynamic stability, typically defined in intensive care environments as when the patient no longer needs vasopressors.

Once this period ends and if the patient remains stable, restrict fluids to 2 L/day and follow a straight catheterization protocol, as ordered. The goal is to achieve a so-called balanced bladder, where fluid intake approximates output. Because overdistention can trigger AD, bladder volumes typically are targeted to 500 mL or less per catheterization.

SCI can cause neurogenic or aneurogenic bladder.

- In *neurogenic* bladder, reflex-initiated voiding may occur when the patient has a full bladder.
- In *aneurogenic* bladder, such voiding doesn't occur, potentially causing overflow urine leakage.

Planned intermittent catheterization can reduce incontinence. Long-term bladder management varies with the patient's bladder type, needs, and lifestyle.

Musculoskeletal management
Patients with SCIs typically experience muscle spasticity as spinal shock recedes and reflexes return. Spasticity may take a flexor or extensor pattern or a combination.

Spasticity can reduce venous pooling and stabilize the thoracic and abdominal muscles used in respiration. It's also associated with chronic pain syndrome, sleep disturbance, fatigue, joint contracture, bone density loss, heterotopic ossification (presence of bone in soft tissue where it normally doesn't occur), and skin breakdown.

Nonpharmacologic strategies to manage spasticity include range-of-motion exercises, positioning techniques, weight-bearing exercises, electrical stimulation, and orthoses or splinting to prevent loss of muscle length and contractures. Pharmacologic therapy may include baclofen, benzodiazepines, alpha$_2$-adrenergic agonists, and regional botulism toxin or phenol injection. In severe cases, surgical options (which are irreversible) may be used.

Dermatologic management
A lifelong complication of SCI, pressure ulcers may threaten not only quality of life but also life itself. Many factors contribute to tissue breakdown and eventual pressure ulcers, including low BP, immobility, friction and shearing forces, unrelieved pressure, moisture, poor nutrition, and nonadherence with preventive strategies.

Prevention and early detection are the cornerstones of pressure-ulcer management. Routinely inspect the patient's skin and use an established skin risk assessment tool, such as the Braden scale. To address identified risk factors, develop a plan of care. Risk-reduction interventions include:

- turning the patient every 2 hours or more (depending on risk assessment findings)
- avoiding positioning the patient on bony prominences, such as the trochanters, sacrum, and heels
- using specialized support surfaces
- minimizing moisture
- frequently inspecting the skin under braces and splints
- using a custom-fit wheelchair with pressure-relieving cushions
- establishing a pressure-release regimen (manual or automated) for wheelchair sitting
- providing nutritional counseling and patient education.

If skin breakdown occurs, consult specialized wound care services for wound assessment and treatment. Treatment options may include both surgical and nonsurgical interventions, depending on wound stage, location, and depth.

> Recovery of function depends on *severity* of the initial injury.

Neurologic improvement
Recovery of function depends on severity of the initial injury. Unfortunately, patients with a complete SCI are unlikely to regain function below the injury level. If some degree of improvement occurs, it usually manifests within the first few days after injury.

Incomplete SCIs usually improve somewhat over time, but this varies with the specific injury. Although full recovery is rare, some patients may be able to improve enough to ambulate and control their bowel and bladder functions.

Supportive and rehabilitative care and treatment
Once the patient is medically stable, care and treatment shift to support and rehabilitation. Family members, nurses, or specially trained aides may provide care, helping the patient bathe, dress, change position, and perform other activities of daily living.

The profound, life-changing implications of SCI for both the patient and family warrant psychosocial, emotional, and vocational support. Before discharge, provide consults for physical and occupational therapy, social work, pastoral care, and financial counseling. Inform the patient and family about available community resources, such as SCI support or advocacy groups.

Preventing SCIs
While recent advances in emergency care and rehabilitation have increased survivability after SCI, approaches for reducing injury extent and restoring function remain limited. No cure for SCI exists, but ongoing research to test surgical and drug therapies continues to progress. In clinical trials, researchers are exploring drug treatments, decompression surgery, nerve cell transplantation, nerve regeneration, stem cell therapy, and complex drug therapies as ways to overcome SCI effects.

With no cure for SCI available, prevention remains key. To help prevent behavior that can lead to this devastating injury, educate the public on how to prevent SCIs. Caution them to always wear seatbelts when in motor vehicles, drive sober, prevent falls by securing rugs and cords, use appropriate safety equipment during sports (such as helmets when cycling, skateboarding, or horseback riding), and avoid diving in water less than 9' deep or if they can't see the bottom of murky water.

An SCI can affect every aspect of life. But with treatment and rehabilitation, many patients can lead productive, independent lives. ★

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Please mark the correct answer online.

1. Significant disc herniation is the most common cause of which type of incomplete spinal cord injury (SCI)?
- a. Anterior cord syndrome
- b. Brown-Sequard syndrome
- c. Cauda equina syndrome
- d. Central cord syndrome

2. The most common type of incomplete SCI is:
- a. anterior cord syndrome.
- b. Brown-Sequard syndrome.
- c. cauda equina syndrome.
- d. central cord syndrome.

3. Loss of pain and temperature sensation on the side opposite the injury is the defining feature of which type of incomplete SCI?
- a. Anterior cord syndrome
- b. Brown-Sequard syndrome
- c. Cauda equina syndrome
- d. Central cord syndrome

4. Which sign or symptom might eliminate the need for further cervical imaging or cervical spine stabilization in a low-risk patient with cervical spine injury after blunt trauma?
- a. Weak hand grip
- b. Lumbar spinal tenderness
- c. No posterior midline cervical spine tenderness
- d. Unsteady gait when walking

5. Which statement related to radiologic evaluation of patients with possible SCI is correct?
- a. Magnetic resonance imaging is not helpful in detecting ligamentous injury that may be compressing the cord.
- b. Magnetic resonance imaging does not provide valuable analysis of the spinal cord.
- c. Computerized tomography (CT) and traditional X-rays are equally acceptable.
- d. Traditional X-rays should be used only if high-quality CT isn't available.

6. Which statement about avoiding respiratory complications in patients with SCI is accurate?
- a. An abdominal binder placed below the costal margin to support the viscera can aid breathing.
- b. An abdominal binder placed above the costal margin to support the viscera can aid breathing.
- c. Vital capacity above 1.5 L suggests decreased inspiratory muscle strength.
- d. Vital capacity above 2 L suggests decreased inspiratory muscle strength.

7. One component of the Institute for Healthcare Improvement's ventilator bundle is:
- a. avoiding prophylaxis for peptic ulcer disease.
- b. weekly sedation interruption to assess readiness to extubate.
- c. at least 15-degree elevation of the head of the bed.
- d. oral care with chlorhexidine.

8. A sign that might indicate a patient with SCI may be in neurogenic shock is:
- a. hyperthermia.
- b. hypothermia.
- c. heart rate of 70 beats/minute.
- d. heart rate of 100 beats/minute.

9. In SCI patients with hypotension, the goal is to sustain a mean arterial pressure of:
- a. 60 mm Hg or higher for 3 days.
- b. 70 mm Hg or higher for 5 days.
- c. 85 mm Hg or higher for 7 days.
- d. 90 mm Hg or higher for 10 days.

10. The most common complication of SCI is:
- a. respiratory impairment.
- b. hypertension.
- c. sympathetic dysregulation.
- d. paralytic ileus.

11. Which statement about autonomic dysregulation is correct?
- a. Treatment includes slow-acting antihypertensive agents.
- b. The most common cause is increased urine output.
- c. Injuries at the T2 level and higher involve the splanchnic vascular bed, which leads to increased blood pressure (BP).
- d. A stimulus activates the spinal reflex mechanism, causing vasoconstriction below the injury level, which in turn raises BP.

12. Which statement about patients with aneurogenic bowel is true?
- a. They lose both voluntary control and reflexive sphincter tone.
- b. They have tight reflexive sphincter tone and retained stool.
- c. They may need a bowel regimen of stool softeners.
- d. They require a digital check of the rectum for retained stool.

13. Which statement about genitourinary management of SCI patients is correct?
- a. Once the acute phase ends and the patient is stable, restrict fluids to 1 L/day.
- b. Bladder volumes typically are targeted to 500 mL or less per catheterization.
- c. In aneurogenic bladder, reflex-initiated voiding may occur when the patient has a full bladder.
- d. Planned intermittent catheterization does not help reduce incontinence.

14. Strategies for managing spasticity in patients with SCIs include:
- a. avoiding weight-bearing exercises.
- b. opioid pharmacologic agents.
- c. orthotics to reduce muscle length.
- d. electrical stimulation.

15. To help patients avoid skin breakdown, the nurse should:
- a. reposition the patient in bed at least every 4 hours.
- b. shift the patient's weight every 60 minutes when the patient is out of bed in a wheelchair.
- c. shift the patient's weight every 30 minutes when the patient is out of bed in a wheelchair.
- d. reposition the patient in bed at least every 3 hours.