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Autonomic dysreflexia in patients with spinal cord injury

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Abstract: Patients with traumatic spinal cord injury have a vast array of secondary pathophysiologic effects, one of which is autonomic dysreflexia (AD). It can be triggered by noxious stimuli and cause severe and fatal consequences that require rapid intervention. This article examines AD and its implications for nursing care.

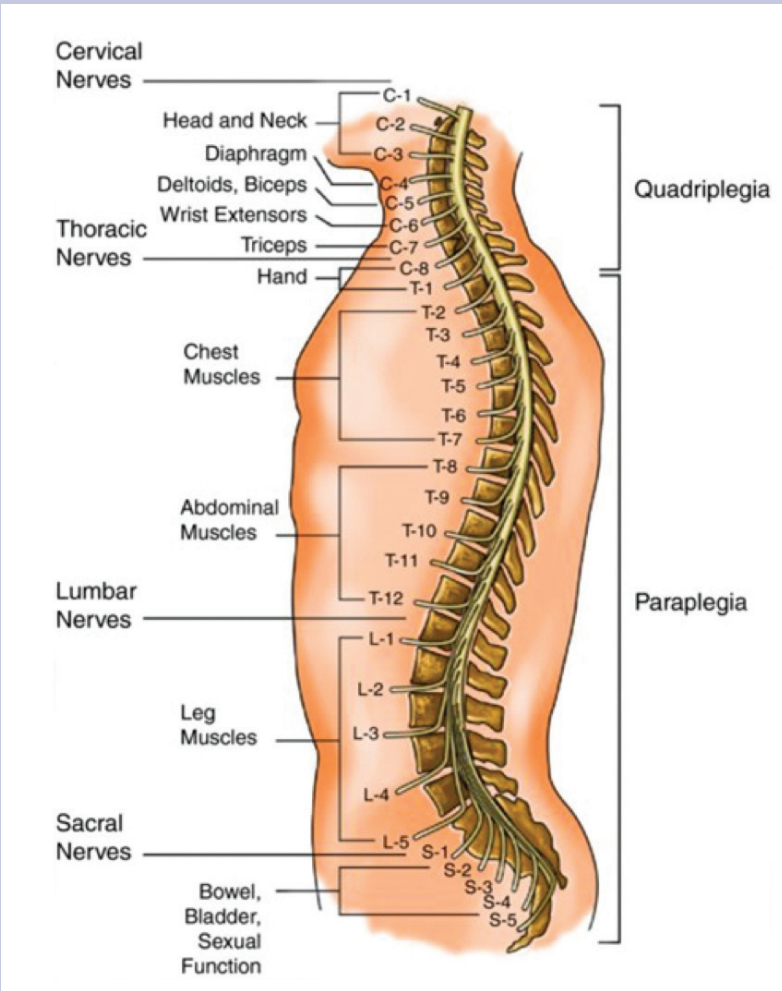
Keywords: spinal cord injury, autonomic dysreflexia, nursing, catheterization, digital stimulation, skin assessment

Case study

JE is a 30-year-old male with a C5-C6 level complete spinal cord injury (SCI). He had paralysis in all four extremities (quadriplegia), limited hand function, and used a power wheelchair for mobility. In addition, he had thermoregulatory dysfunction, spasticity that contributed to contractures of his hands, and frequent episodes of autonomic dysreflexia (AD). Causes of AD included bladder distension due to an obstructed suprapubic catheter, bowel distension due to fecal impaction, and a pain stimulus. Despite these challenges, he lived alone with the daily assistance of an unlicensed assistive personnel and supplemental support of a respite care nurse.

One day, the nurse helped him to bed and returned 30 minutes later to

Level of SCI and functional loss



The higher the SCI, the more motor, sensory, and autonomic functional losses are incurred.

Credit: Hickey J. *Clinical Practice of Neurological & Neurosurgical Nursing*. Wolters Kluwer Health. ISBN:9781451172676.2013.

find him with flushing of the skin and profuse diaphoresis of the face and neck and complaining of a severe generalized headache. His vital signs were BP, 120/75 (baseline 80/50); heart rate, 120; respirations, 22; oral temperature, 96.7 °F (35.9 °C); and SpO_2, 94% on room air.

After the nurse sat JE upright to cause orthostatic lowering of his BP she assessed his suprapubic catheter tubing for urine flow and performed gentle manual evacuation of fecal impaction. Following these interventions, JE's BP returned to its normal range, and his other signs and symptoms resolved. His vital signs then were BP, 82/56; heart rate, 60; respirations, 12; oral temperature, 98.2 °F (36.8 °C); and SpO_2, 94% on room air.

The nurse massaged his forehead to help reduce his anxiety and sat with him until he fell asleep 30 minutes later.

Introduction

Approximately 299,000 people live with an SCI in the US, with about 18,000 new SCIs occurring each year.[1] Quadriplegia is the most frequent neurologic category, comprising approximately 46.8% of all SCIs.[1]

AD is a syndrome caused by SCI typically affecting those with an injury at the sixth thoracic vertebral level (T6) or higher. AD occurs due to the loss of coordinated autonomic responses to demands on heart rate and vascular tone. The higher the level of injury, the higher the risk of AD. Up to 90% of those with cervical spinal or high-thoracic SCIs are likely to experience AD.[2] While this disorder is very common among those with SCIs, many patients treat mild signs and symptoms at home such that when patients present to a clinic or ED with severe signs and symptoms, clinicians may not know how to recognize and treat them.[2,3] Treatment delays can result in potentially fatal consequences. Rapid recognition of AD signs and symptoms and immediate treatment, sometimes as simple as unkinking a urinary drainage catheter tubing, can save a patient's life.[2]

Spinal cord anatomy and physiology

The spinal column consists of 33 bony vertebrae: 7 cervical, 12 thoracic, 5 lumbar, 5 sacral (fused), and 4 coccygeal (usually fused). The vertebral column provides the body's basic structural support and protects the spinal cord and spinal nerves. Spinal nerves innervate the vertebrae at each level and allow communication between the brain and specific body areas. Because the spinal cord is shorter than the vertebral column, vertebral and spinal cord segmental levels are not the same. The level of injury dictates the severity of the SCI (see *Level of SCI and functional loss*).

The absence of sensory and voluntary motor function below the level of injury occurs with a *complete* SCI. An *incomplete* SCI occurs when there is partial preservation of sensory or voluntary motor function.

Pathophysiology of AD

Noxious stimuli below the level of the SCI trigger an exaggerated sympathetic nervous system response from T6 to L2 due to posttraumatic cord hypersensitivity and a lack of compensatory parasympathetic stimulation. Diffuse vasoconstriction occurs below the level of the SCI typically, in the lower two-thirds of the body, and can cause a severe rise in BP.[2,4] This rise in BP normally stimulates the baroreceptors in the carotid sinus and aortic arch, triggering a parasympathetic response to slow the heart rate by stimulating the vagal nerve and causing vasodilation. However, the spinal cord lesion blocks the parasympathetic response. Although vasodilation occurs above the SCI, uncontrolled vasoconstriction occurs below it.[2,4] This uncontrolled sympathetic response can cause retinal hemorrhage, seizures, stroke, pulmonary edema, or cardiac arrest.[5,6]

AD triggers

The most common causes of AD can be categorized as the "six Bs"[4]: **b**ladder, **b**owel, **b**ack passage, **b**oils, **b**ones, and **b**abies (see *AD triggers: Six Bs*).

One study showed that 60% of people with an SCI needed some form of catheterization to empty their bladder at least some of the time.[7] In patients with an SCI, the sensation of bladder fullness as well as motor control of bladder and sphincter function are impaired, so catheterization every few hours can help to avoid an AD episode. Alternatively, some patients will have a suprapubic or indwelling urethral catheter to empty their bladder. If the patient forgets to catheterize themselves or their indwelling catheter becomes obstructed, the patient's bladder will not empty, and AD can result (see *Tips for catheterization*).

Bowel issues, including constipation and fecal retention, can also trigger AD.[2,4,6] Most patients with SCIs cannot defecate on their own, so they rely on a course of stool softeners, suppositories, or enemas and digital stimulation to empty their bowels. Digital stimulation involves inserting a lubricated, gloved finger into the rectum and applying physical stimulation to the rectal wall to stimulate peristalsis.[8] Each stimulation should be followed by abdominal massage to reduce colonic transit time (see *Tips for digital stimulation*).[8] If not done routinely, along with other components of the prescribed bowel regimen, the patient can develop constipation or fecal impaction.

Pain is another common cause of AD and another outcome of an SCI that notably affects a patient's quality of life.[9] A significant number of patients develop chronic pain syndrome several months to years after SCI, including neurogenic pain. Other sources of pain include hemorrhoids, fissures, skin breakdown, or fractures.[4] Patients with SCIs are at high risk for skin breakdown due to limited sensation and movement. A critical aspect of preventing AD triggered by pain is to perform comprehensive skin assessments, including assessing for pressure injuries and frequent turning and repositioning, at least every 2 hours (see *Tips for skin care*).[6]

AD triggers: Six Bs[4]

Bladder: urinary tract infection, urinary retention, renal calculi, obstructed urinary drainage catheters, bladder spasms

Bowel: constipation, fecal impaction

Back passage: rectal issues, hemorrhoid, anal abscess, fissure

Boils: skin damage, infected ulcers, pressure injuries

Bones: fractures, dislocations

Babies: pregnancy, sexual intercourse, breastfeeding

A patient's perspective

I suffered a C5 traumatic SCI 11 years ago due to a rugby tackle in which my neck collided with an opponent's knee. As a result, I use a wheelchair for mobility, and all my bodily functions have been affected.

For some with SCIs, AD rarely occurs; but it is a part of my everyday life. Most doctors are stumped by it because it is so frequent–it is not uncommon for me to have AD 10 times a day or more. I will be outside or at a party and randomly begin sweating profusely. Most people who see it think I am overheated because I live in a humid climate, but it is a pain stimulus causing AD.

Sometimes my suprapubic catheter tube is clogged. Changing it results in more pain. Other times, my bowels are irritated, my anal sphincter is too tight, and I cannot release pressure from flatulence. Every day presents new challenges to be addressed.

I have never gone to the hospital for these episodes. Instead, I manage them at home alone with an aid, a nurse, or anyone else available. SCI and the resulting AD can be a struggle and make my days challenging. I suffer a lot from AD symptoms, but I believe my attitude is a daily choice. My SCI limits my physical abilities, but I can choose to embrace my situation with a good attitude to improve any circumstance. By understanding AD as a critical aspect of hospital care, healthcare professionals can play a big part in helping make sure that patients like me have the best quality of life.

Tips for catheterization

If patients with SCI can self-catheterize, they may only need extra support when dealing with AD. For instance, the nurse can help them prepare their catheter supplies so they can quickly insert the catheter or catheterize for them. If the male's penis is buried from penile retraction or is erect, the nurse may need to hold the base of the penis to help the patient insert the catheter. The nurse must realize that patients cannot control their body's response and need calm support. If a patient's indwelling urinary catheter or suprapubic catheter is obstructed, the quickest solution is to remove the old catheter and replace it with a new one.[2] While milking can release sediment, this is too slow of a process, and time is of the essence when treating AD.

Patients should be encouraged to wear clothing that fits well or is slightly oversized and avoid wearing underwear to prevent putting pressure on the skin.[10] In addition, patients should be encouraged to sleep with their skin, especially their groin, open to air.[10,11] This positioning helps prevent bacteria growth from moisture and can help prevent wound development from the pressure of clothing combined with limited position changes overnight.[10,11]

Sexual intercourse, pregnancy, or breastfeeding can also cause AD.[4,6,12] Many males with SCIs take an oral phosphodiesterase-5 (PDE5) inhibitor, such as sildenafil, to stimulate an erection which can affect BP and cause AD.[13,14] It is important to remember that PDE5 inhibitors can potentiate the hypotensive effects of nitrates, alpha-blockers, and antihypertensives. Nitrates should not be administered to patients who may have taken sildenafil or other PDE 5 inhibitors within 24 hours (or within 48 hours of taking tadalafil) due to the potential for refractory hypotension.[12]

Spasticity or AD?

Muscle spasms can present with similar signs and symptoms to AD and may also trigger AD due to the intense pain they cause. Spasticity is elicited by a quick passive movement of the limb. It is believed to result from the disruption of descending inhibitory modulation of the alpha motor neurons, producing hyperexcitability, which results in increased muscle tone and spasms.

Tips for digital stimulation

Place absorbent pads under the patient, and position the patient on their left side. Put lubricant on the forefinger of your gloved hand, insert it into the rectum with fingertips toward the spine and not toward the bladder, and remove any stool in the lower rectum.[9] Insert a suppository or administer an enema. Wait for 10 to 15 minutes or longer if needed per medication instructions. Next, insert a gloved finger into the rectum and move it in a circular motion for 10 rotations. Remove any stool.

Massage the patient's abdomen in the direction a regular evacuation of the intestines would occur: RLQ, RUQ, epigastric, LUQ, and LLQ.[8] Reinsert the finger into the rectum and move in a circular motion for another 10 rotations and remove any stool. Do this for four total cycles or until the patient is fully evacuated.

Digital stimulation can also be done while a patient sits on a shower chair, allowing gravity to help remove stool. Patients may also need stimulation to eliminate flatus from their rectum depending on the tightness of their anal sphincter. If the patient is experiencing AD, their sweating will often stop after expelling the flatus or evacuating the stool.

If a patient develops spasticity, physical therapy, regular stretching, and the use of braces can help maintain range of motion and prevent contractures. Physical therapists can be an excellent resource for teaching the patient techniques to use for muscle stretching.

Clinical manifestations

A patient with AD may complain of headache, blurred vision, spots in the visual field, nasal congestion, nausea, and a sense of anxiety or malaise.

Because BPs are often low in patients with quadriplegia, elevations may not be recognized in this setting unless compared with baseline levels, as demonstrated in the case study. Bradycardia is common; however, some patients like JE have tachycardia. The patient may have profuse diaphoresis and flushing of the skin above the level of the SCI like JE.

Diagnosis

AD diagnosis and treatment require prompt recognition of signs and symptoms. The patient's baseline vital signs, especially BP, should be documented upon admission. A systolic BP (SBP) elevation of 20 mm Hg or more is considered a sign of AD.[2,4,5] AD is considered to be severe if the SBP is 150 mm Hg or more or if the systolic BP is 40 mm Hg above the patient's baseline.[2] If the patient with an SCI at or above T6 complains of a severe headache and has an elevated BP, assume that they are experiencing AD and need immediate treatment.[2,3]

Pharmacotherapy

The most common medications to treat AD are rapid-onset, short-duration agents, depending on the severity of the episode and the patient's response to nonpharmacologic interventions. Oral nifedipine and 2% nitroglycerin paste are frequently

used. Instruct patients to "bite and swallow" the immediate-release form of nifedipine, which is preferred over sublingual administration.[2,6] For adults with AD, 1 or 2 inches of nitroglycerin paste may be prescribed and applied above the level of SCI. When the BP has stabilized, the area should be wiped clean to avoid additional lowering of the BP below a safe level.[6] Assess a patient's BP every 2 to 5 minutes until it returns to normal and the patient is stabilized.

Implications for nursing care

Nurses may encounter patients with AD in various inpatient and outpatient settings, including home care, an ED, or a clinic. Regardless of the setting, it is critical to determine priorities quickly when caring for a patient with AD as this is a medical emergency. Preserve the patient's dignity as much as possible. Nurses can help a patient with AD by asking what they need and assisting as requested. The patient may be able to take the lead as they are usually familiar with their signs and symptoms and typically know what needs to be done to manage AD.[2]

If the patient says they have AD or displays signs and symptoms of AD, such as a severe headache, the priorities are to measure and monitor BP, and if the BP is elevated, to sit them upright quickly to promote an orthostatic drop in BP, and remove any restrictive clothing or devices.[4,6,12]

The nurse should ask the patient what their normal BP is, what typically triggers their AD, and what they do to relieve it—and prioritize additional interventions based on the patient's answers. Suppose nursing actions, such as assessing urinary drainage tubing for kinks or obstructions, helping the patient perform intermittent urinary catheterization, replacing the indwelling urinary catheter, and assessing the patient's rectum for stool or fecal impaction, do not quickly resolve the AD. In that case, an antihypertensive agent may need to be administered, typically a rapid-onset, short-duration agent.[2,6,12]

Monitor BP and pulse every 2-5 minutes until the patient has stabilized, usually for at least 2 hours to ensure that elevation of the BP does not recur.[4]

For patients in the community, the procedure may look different. For example, they may suddenly develop diaphoresis and a headache. A BP cuff may not be readily available, but the nurse can pay close attention to the patient's signs and symptoms and help with any procedures needed. If the AD signs and symptoms do not resolve quickly, call 911. Also, ask the patient if they have taken any medications like PDE5 inhibitors in the last 24-48 hours and relay this information to the emergency personnel so they know what medications they can safely administer.

While AD is a medical emergency, it is very common among many individuals with SCI and may have become a part of their daily lives. Nurses must have regular conversations with patients about the frequency of their signs and symptoms and typical treatments to provide appropriate support including preventive measures. Nurses must also learn patient cues to discern when they need quick intervention, such as urinary catheterization or a call to 911. Quickly recognizing the signs and symptoms of AD and providing immediate treatment can save the life of a patient with SCI. ■

Tips for skin care

Patients with SCIs need daily skin assessments. This involves helping them fully undress and assessing them from head to toe, with particular attention paid to all pressure areas and skin folds. Pressure areas include the back of the head, ears, shoulders, elbows, back, buttocks, sacrum, hips, front and back of knees, and heels. Areas with skin folds can include breasts, stomach, armpits, groin, and male genitalia. Any part of the body that can rub against something can potentially develop a wound. A full-body skin assessment is vital if a patient has AD and the cause cannot be found.

Tips for addressing personal issues

Depending on the patient's level of injury, they may have full or partial loss of function in two or more limbs and lose the ability to urinate, defecate, and ejaculate even when an erection is possible.[12] These body changes, often brought on by traumatic events or injuries, can leave the patient feeling distressed and concerned for the future.

While these issues are very personal, it is vitally important that healthcare professionals ask patients about their current functions and needs. Providing excellent care involves asking about sexual function and providing appropriate genital assessments.

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The authors and planners have disclosed no potential conflicts of interest, financial or otherwise.

DOI-10.1097/01.NURSE.0000902944.16062.1f

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