

An important cardiovascular complication in spinal cord injury patients: Autonomic dysreflexia

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Abstract

Autonomic dysreflexia (AD) is a life-threatening complication of spinal cord injury (SCI) at T6 or above that results in an uncontrolled sympathetic discharge in response to noxious stimuli. It is a symptom complex characterized by a lethal rise in blood pressure with dangerous consequences. Autonomic dysreflexia is often secondary to urological, gastrointestinal, or gynecological problems or manipulations. Early recognition and prompt treatment of AD is vital to prevent complications, including death. Its management starts primarily with its prevention. Easy measures can avoid this high risk event, and physicians should be aware of the simple procedures and the possible treatment cascade that could be undertaken. The purpose of this systematic review is to review the clinical data on the mechanisms and pathophysiology of this condition and the clinical evidence about the various strategies currently used to prevent and manage AD in the SCI population; and to improve awareness of AD among cardiologists, family physicians and medical personnel in the emergency department. (Cardiol J 2011; 18, x: xx–xx)

Key words: autonomic dysreflexia, hypertension, cardiovascular events

Introduction

Autonomic dysreflexia (AD) is a potentially life-threatening condition characterized by a sudden uncontrolled sympathetic response secondary to noxious stimuli resulting in a sudden rise in blood pressure with dangerous consequences. It especially occurs in patients with an injury at level T6 or above [1–4]. The higher the level of spinal cord injury (SCI), the more severe the bouts of AD, as measured by the level of hypertension. Another important factor relating to the severity of AD is the completeness of the spinal injury: only 27% of patients with incomplete tetraplegia present with signs of AD, compared to 91% of patients with tetraplegia with complete lesions [5]. In addition, the

AD reaction is provoked by a noxious stimulus entering the spinal cord below the level of injury. If more than one peripheral stimuli is present simultaneously, it seems that the reaction is more severe and more readily activated [6].

The incidence of AD is reported as between 48% and 98% in patients with quadriplegia and high paraplegia. It usually occurs within the first six months after injury, but can occur up to 13 years later [7].

Pathophysiology

It is known from animal experiments that autonomic instability after SCI results from changes occurring within the spinal and peripheral autonomic

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circuits, both in the acute and chronic stages after injury. A noxious stimulus (i.e. one that might be expected to cause pain or discomfort in a person without SCI) below the level of the lesion produces an afferent impulse that generates a generalized sympathetic response, which in turn results in widespread vasoconstriction, most significantly in the splanchnic vasculature, which causes an increase in peripheral resistance and a shunting of the normal blood that is congested, thereby forcing it to enter into the general circulation [8, 9].

The combination of the increased vasoconstriction and the increased fluid load in the vascular space causes a potentially catastrophic increase in blood pressure (BP). Systolic BP can increase to as high as 300 mm Hg, diastolic BP to as high as 200 mm Hg [10–17].

The brain detects this hypertension crisis through intact baroreceptors and stimulates the parasympathetic nervous system in an attempt to lower BP. The parasympathetic overactivity (and lack of sympathetic tone) above the level of the lesion results in peripheral vasodilation and is thought to be responsible for the headache, flushing and sweating in the head and neck region, and the nasal congestion [9, 18].

Clinical features

Autonomic dysreflexia can present with a variety of symptoms and can vary in intensity from asymptomatic, to mild discomfort, to a life-threatening emergency. Normally, patients with SCI at T6 or above have systolic BP of 90 to 110 mm Hg. A sudden 20 to 40 mm Hg increase of systolic and diastolic BP over baseline that is frequently associated with bradycardia may indicate AD. In addition, an elevation of systolic BP of 15 to 20 mm Hg in adolescents, or higher than 15 mm Hg above baseline in children, is significant and may suggest AD [19, 20]. It is accompanied by at least one of the following signs (sweating, piloerection, facial flushing, cold peripheries), or symptoms (headache, blurred vision, stuffy nose, chest tightness) [21–24]. The differential diagnosis includes migraine and cluster headaches, essential hypertension, posterior fossa tumors, pheochromocytoma and toxemia of pregnancy [25].

Besides bradycardia, other cardiac abnormalities may be encountered, such as cardiac arrhythmias (atrial fibrillation, premature ventricular contraction, and atrioventricular conduction anomalies) [26–28]. Like chronic hypertension, AD can lead to cardiovascular damage. Cervical or high-thoracic

(T6 or above) severe SCI deprives patients of supraspinal sympathetic control of cardiovascular functions that include coronary blood flow, cardiac contractility, and heart rate. Disordered cardiac control may account for the prevalence of asymptomatic coronary artery disease after SCI. And abnormal peripheral vasomotor responses due to decentralized regulation of vascular tone and BP control are seen in these patients, who develop low resting BP, orthostatic hypotension, and loss of diurnal fluctuation of BP [29].

Precipitants

A variety of non-noxious or noxious stimuli can trigger episodes of AD. The commonest triggering factor is bladder distension because of urinary retention or catheter blockage, and accounts for up to 85% of cases. Pain or irritation within the colorectal area is the second commonest cause, accounting for 13% to 19% of cases. Constipation, hemorrhoids, and anal fissures are frequently observed in patients with SCI and contribute to episodes of AD [30]. In addition to urinary and gastrointestinal triggers, a long list of other potential precipitative factors has been reported. Among the more common of these are cutaneous triggers such as pressure sores and ingrown toenails. In addition, other factors include: urological endoscopic procedures such as cystoscopy or urodynamics, urinary infections, bladder calculi, surgical stimulation, pregnancy or childbirth, and any other traumatic or painful stimulus. Less common triggers include deep vein thrombosis, pulmonary embolism, syringomyelia and sexual activity [30, 31].

Treatment

Early recognition of signs and symptoms of AD is a major key to immediate and appropriate treatment of this urgent condition. Late recognition or inappropriate management may result in severe hypertension and complications such as seizures, intracranial and retinal hemorrhages, myocardial irregularities, coma, and even death [32–37].

Treatment consists of identifying and removing the trigger for AD and managing symptoms to prevent complications. The initial management of an episode of AD involves placing the patient in an upright position to take advantage of any orthostatic reduction in BP. The next step in managing acute AD must be to loosen any tight clothing and/or constrictive devices. This procedure allows further blood pooling in vessel beds below the level of in-

jury and removes possible triggers for peripheral sensory stimulation [4, 38–40]. Blood pressures have the potential of fluctuating quickly during an AD episode. Therefore, pressures need to be monitored every few minutes (every 2 to 5 min is commonly cited), until the individual is stabilized [18, 24]. Identifying the possible trigger and decreasing afferent stimulation to the spinal cord appear to comprise the most effective non-pharmaceutical therapeutic strategy in clinical practice. Thus, it is necessary to search for and eliminate the precipitating stimulus, which, in 85% of cases, is related either to bladder distention or to bowel impaction [18, 30, 31]. When the inciting event is not apparent, more severe precipitants of dysreflexia (e.g. pulmonary embolism) must be considered and ruled out [18, 41].

If signs and symptoms of AD persist despite these measures, initiation of antihypertensive therapy is indicated. There are no studies to show the threshold value at which the elevated BP becomes dangerous [42]. As recommended in the Guidelines of the Consortium for Spinal Cord Medicine for the management of AD, non-pharmacologic measures must be employed initially; if they fail, and systolic BP continues to be at or above 150 mm Hg in an adult, 140 mm Hg in an adolescent, 130 mm Hg in a child six to 12 years old, or 120 mm Hg in a child under five years old, some type of pharmacologic agent should be initiated [24].

Antihypertensive medication should preferably have a rapid onset and short duration of action [18]. Numerous pharmacologic agents (e.g. nifedipine, nitrates, captopril, terazosin, prazosin, phenoxybenzamine, prostaglandin E₂, sildenafil) have been proposed for the management of AD episodes [18, 24].

Nifedipine and nitrates are the most commonly used agents. Traditionally recommended for AD is immediate-release nifedipine through the bite and swallow method. However, because of several reports of serious adverse reactions occurring after immediate-release nifedipine for hypertensive crises in other populations, the Joint National Committee on the Detection, Evaluation, and Treatment of High Blood Pressure has discouraged use of this drug [43].

Nitrates have been used for acute episodes of AD. Before nitrates (e.g. nitroglycerin, isosorbide dinitrate, or sodium nitroprusside) are administered, a person with a SCI presenting with acute AD should be questioned regarding use of sildenafil. If this agent has been used within the last 24 h, it is recommended that an alternative, short-acting, rapid-onset, non-nitrate antihypertensive agent be

used [11, 24]. Captopril is a specific competitive inhibitor of angiotensin converting enzyme. A prospective, open-label study and numerous expert opinions suggest the use of captopril as a primary medication in the management of AD. During an acute episode of AD, 25 mg captopril is often administered sublingually [24, 44–46]. Terazosin and prazosin are long-acting, alpha-1 adrenoceptor selective blocking agents. Selective alpha-1 blockade has been suggested as an appropriate pharmacologic choice in the management of AD because of its added effect at the bladder level, which includes inhibition of the urinary sphincter and relaxation of the smooth muscles of blood vessels [47–50]. But, as an alpha-receptor blocker, tamsulosin is not recommended in the acute treatment of AD. Although sildenafil decreased resting BP, there was no effect on the magnitude of AD resulting from vibrostimulation in men with SCI [51]. In addition, there have been reports on the use of beta-blockers, mecamlamine and, rarely, intravenous hydralazine, sodium nitroprusside or diazoxide for the general management of AD symptoms in subjects with SCI [6, 51].

The resolution of the episode of AD should be followed by monitoring of symptoms, BP, and heart rate for at least 2 h to make sure it does not recur [18, 24]. If the BP is well controlled and serious causes are ruled out, the patient can be discharged and other investigations can be done on an outpatient basis [18].

Prevention

The key to successful management is prevention through patient and family education, proper bladder, bowel, and skin care, and identification and avoidance of noxious stimuli. Unfortunately, the level of awareness of AD among family physicians and medical personnel in the emergency department or ambulance services appears to be low, especially as it pertains to patients with SCI [24]. Clinicians, family members, and caregivers should be aware that increased afferent stimulation (e.g. via surgery, invasive investigational procedures, and labor) in persons with SCI will increase their risk for AD and that a variety of procedures can be used to prevent AD episodes [18].

In patients with recurrent attacks, an alpha-adrenoceptor blocker may result in some suppression of dysreflexic symptoms; a nightly dose of terazosin, 5 mg, or tamsulosin, 0.8 mg, may reduce the frequency and severity of AD. Acute AD may be precipitated by surgical, cystoscopic, urodynamic,

and radiologic procedures. Prophylactic nifedipine, 10 mg, or nitropaste 2% could therefore be given shortly before the procedure, especially if the patient is known to have recurrent acute AD episodes. Prophylactic treatment of chronic patients with an alpha-adrenoceptor blocker or premedication before a procedure does not eliminate the need for careful monitoring during provocative procedures [21, 35, 52, 53]. However, conservative management is not always successful, and alternative strategies (e.g. botulinum toxin, capsaicin, anticholinergics, sacral denervation, bladder and urethral sphincter surgery) are required to decrease afferent stimulation from the urinary bladder, thereby preventing the development of AD [20, 37].

Conclusions

As a result, AD can be quickly treated and reversed by consumers themselves, family members, or pre-hospital providers. In most cases, the prompt emptying of a patient's bladder and/or bowels will resolve most AD episodes. When other precipitants may not be addressed in the pre-hospital setting, the patient with acute AD and elevated BP should be referred to the nearest emergency department for management.

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