Blood Pressure Response to Acupuncture in a Population at Risk for Autonomic Dysreflexia

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ABSTRACT. Averill A, Cotter AC, Nayak S, Matheis RJ, Shiflett SC. Blood pressure response to acupuncture in a population at risk for autonomic dysreflexia. Arch Phys Med Rehabil 2000;81:1494-7.

Objective: To determine whether acupuncture can lead to autonomic dysreflexia (AD) when used to treat chronic pain in individuals with spinal cord injury (SCI).

Design: Acupuncture analgesia study.

Setting: Medical rehabilitation research center.

Participants: Fifteen participants with post-SCI chronic pain who were at risk for AD (ie, SCI at or above T8).

Interventions: Half-hour acupuncture treatment sessions twice a week for 7.5 weeks, for a total of 15 treatments. Acupuncture needles were inserted both above and below the patient's spinal lesion level. Blood pressure (BP) was measured before and after acupuncture treatments.

Main Outcome Measures: Systolic BP (SBP) and diastolic BP (DBP). Participants monitored for signs and symptoms of AD.

Results: On average, SBP and DBP remained stable across all 15 treatment sessions. None of the participants experienced any symptoms of AD. However, examination of individuals' BP readings indicated acute elevations (20mmHg or higher) in SBP for 3 of the 15 participants.

Conclusions: Although none of the 15 participants who were at risk for developing AD developed symptoms consistent with this diagnosis, 3 displayed an acute elevation in SBP, suggesting a pattern of imminent AD. Comorbid hypertension appeared to contribute to the elevation in 1 patient. Therefore, careful monitoring of patients with SCI or hypertension during acupuncture treatments is advisable.

Key Words: Acupuncture; Autonomic dysreflexia; Blood pressure; Rehabilitation; Spinal cord injuries.

THE REPORTED incidence of autonomic dysreflexia (AD) among individuals with spinal cord injuries (SCIs) ranges from 48%[1] to 85%.[2] Clinically, AD presents as hypertension, and may be associated with bradycardia, severe headache, perspiration and flushing above the level of the lesion, anxiety, nasal congestion, cardiac arrhythmias, visual changes, and goose bumps above or below the lesion. Usually these signs and symptoms are precipitated by noxious stimuli below the level of the spinal cord lesion in persons with injuries at or above the midthoracic (T6–T8) level. An elevation in blood pressure (BP) of 20 to 40mmHg above the baseline value may be considered to be a sign of AD.[3] Acute hypertension can be potentially dangerous and have grave consequences including stroke and seizure, and, therefore, must be monitored closely and treated as a medical emergency. The most common causes of AD are bladder distention and bowel distention. It may, however, be caused by any painful or irritating stimuli below the level of the lesion, including contact with sharp objects or an ingrown toenail.

The prevalence of chronic pain after an SCI is estimated to range from 18% to 64% for severe disabling pain and from 48% to 94% for mild to moderate pain.[4-8] Over one third of individuals with SCIs report that pain interferes with their quality of life and functioning.[4,5] Despite the prevalence of pain after an SCI, pain management is frequently inadequate.[9] Because acupuncture is a recently recognized treatment for pain in the United States, the primary goal of the study from which this data set was extracted was to explore its efficacy in the treatment of chronic pain after an SCI.

Acupuncture is an effective means to control various types of pain,[10-13] and has been recognized by the National Institutes of Health (NIH) as potentially useful for a variety of chronic pain conditions[14] or for patients in whom conventional treatments are ineffective. Because there are almost no adverse effects associated with acupuncture in the general population, it is a reasonable choice for some patients with chronic pain.[13,15] Acupuncture is theorized to have local, segmental, and central pain-mediating effects involving the somatic and autonomic nervous systems.[16]

Safety, practicality, and versatility make acupuncture a useful tool for specialists treating complicated pain presentations in the general population. However, clinicians may be reluctant to perform or recommend acupuncture to persons with SCIs in anticipation of precipitating AD. Because acupuncture treatments involve the insertion of needles at specific points on the body (both above and below the level of injury), the occurrence of AD was considered to be a potential risk, though no cases of AD in association with acupuncture have been reported in the literature. Therefore, participants were carefully monitored throughout the study for signs and symptoms of AD.

Results of the effectiveness of acupuncture in treating pain will be reported elsewhere. The focus of this article is the risk of AD from acupuncture. Specifically, we investigated whether acupuncture given for analgesia in patients with an SCI appreciably affected BP (because an acute elevation in BP is con-

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sidered a hallmark of impending or existent AD, and is an appropriate physical sign to observe when monitoring for AD).

METHODS

Participants

Fifteen individuals with SCI at or above T8 were selected from a sample of 23 participants involved in a research study on the efficacy of acupuncture in the treatment of chronic pain after an SCI, conducted at Kessler Medical Rehabilitation Research and Education Corporation. These 15 participants were selected because their SCIs were above the thoracic sympathetic outflow (T6–T8) and, thus, they were at risk of developing AD. The level of SCI in this group ranged from T8 through C3, with 4 participants having injuries at C4; 2 participants at C3, T4, and T7; and 1 participant at C5, C7, T1, T6, and T8. Ten participants were classified as American Spinal Injury Association (ASIA) A (complete) and 5 participants as ASIA D (incomplete). The duration since injury ranged from 1 to 41 years, with a mean duration of 11.5 years (SD = 11.42). Participants ranged in age from 29 to 74, with an average age of 48.13 years (SD = 13.55). Ten participants were men and 5 were women. Three of the 15 individuals had a history of AD.

Procedure

Participants received half-hour acupuncture treatments twice a week for a total of 7.5 weeks. Two physiatrists trained in medical acupuncture conducted the treatments. The treatment protocol involved the insertion of acupuncture needles[a] at specific points on the body, both above and below the level of injury, during each of the 15 treatment sessions. All needles were 0.2mm in diameter, 30- to 40-mm long, and made of stainless steel. They were new, disposable, sterilized, and individually wrapped. The needles were inserted to a depth of approximately 15 to 30mm.

Before each acupuncture session, participants were asked if they had any new medical problems, change in their symptoms, or any problems that they related to the acupuncture. Previously used acupuncture points were also examined for evidence of infection. Immediately after acupuncture, participants were asked how they felt and if they had experienced any adverse effects of the treatment.

All participants were monitored during medical sessions for occurrences of AD developing in response to needle insertion. The acupuncturists checked for any unusual signs and symptoms, including severe headache, profuse sweating, flushed or reddened skin, goose bumps, visual changes, nasal congestion, anxiety, and any apparent cardiac irregularities. In addition, BP was monitored immediately before and after each session using a mercurial sphygmomanometer.[b] Research personnel specifically checked for any acute elevation in systolic BP (SBP) or diastolic BP (DBP) (ie, 20–40mmHg) above baseline immediately after each acupuncture session.[17]

Because little is known about the normal BP response to acupuncture, BP data were obtained from the charts of 20 rehabilitation outpatients who did not have SCIs. These patients sought treatment at the Acupuncture Service at the Kessler Institute for Rehabilitation. BP data from before and after a single acupuncture session was obtained. These individuals had been treated for a variety of symptoms and diagnoses, including pain, gastrointestinal symptoms, and post-stroke symptoms, and were not at risk for AD. The group included 10 men and 10 women whose mean age was 46.65 ± 18.39 years.

Table 1: BP Readings Taken Before and After 15 Acupuncture Treatment Sessions

	Systolic (n = 15)		Diastolic (n = 15)	
Session	Pretreatment	Posttreatment	Pretreatment	Posttreatment
1	111.09 ± 19.09	110.1 ± 19.13	71.9 ± 10.73	69.7 ± 11.89
2	110.23 ± 17.26	112.92 ± 19.39	70.15 ± 9.68	68.31 ± 10.67
3	114.36 ± 19.69	113.86 ± 19.33	67.86 ± 13.98	70.64 ± 11.02
4	110 ± 20.85	113.62 ± 17.95	68.92 ± 12.18	69.62 ± 10.52
5	113.07 ± 22.95	114.21 ± 21.18	74.14 ± 12.88	73.57 ± 12.73
6	110.92 ± 18.59	112.46 ± 19.67	70.31 ± 13.09	70.85 ± 12.69
7	109.71 ± 17.83	109.14 ± 16.93	69.36 ± 11.13	70.07 ± 11
8	109.08 ± 18.47	110.92 ± 19.12	70.62 ± 10.07	70.23 ± 9.34
9	111.38 ± 14.48	112.23 ± 17.61	69.08 ± 9.37	71.62 ± 8.3
10	109.08 ± 20.61	112.69 ± 19.55	67.54 ± 10.81	70.08 ± 9.89
11	115 ± 21.79	114.69 ± 19.53	73.92 ± 9.54	71.08 ± 10.19
12	112.5 ± 14.46	111.17 ± 17.9	70.92 ± 8.77	70.33 ± 9.59
13	110.4 ± 17.71	112.7 ± 18.57	70.5 ± 11.6	71.7 ± 7.86
14	114.56 ± 19.44	117 ± 20.51	72.1 ± 11.52	70.3 ± 9.53
15	113.36 ± 17.33	117.36 ± 18	70.27 ± 8.72	72.27 ± 9.17

NOTE. Values presented in mean mmHg ± SD.

RESULTS

Participants were routinely monitored for signs and symptoms of AD during acupuncture treatments. During each of the 15 sessions, none of the 15 participants reported any symptoms (ie, severe headache, profuse sweating, flushed or reddened skin) that would indicate the occurrence of dysreflexia.

As a primary indicator of AD, mean SBP and DBP readings were calculated both before and after acupuncture treatments (table 1). Paired t tests were used to assess changes in both mean SBP and DBP before and after acupuncture treatments for the 15 participants in this study. The results indicate no statistically significant changes in either reading of the BP during any of the 15 acupuncture treatments.

Individual changes in BP readings were then examined to determine whether there had been any acute changes specific to any of the participants (table 2). There were no significant changes in DBP. Three of the 15 participants had acute elevations in SBP (defined as an increase of 20mmHg or more above baseline). Two of these individuals had such elevations in SBP at only 1 of the 15 treatment sessions. The third individual experienced an increase in SBP in 5 of 15 treatment sessions (range, +28 to +36mmHg). This participant was also the only one in the group with a history of hypertension. All 3 individuals with acute elevations had complete thoracic injuries (T7–T8). None had a history of AD. None of the participants had any other associated signs or symptoms of AD.

For 3 other participants, acute reductions in SBP were observed (table 2). This occurred in only 1 of the 15 treatment sessions for each individual, each with a decrease of 20mmHg below baseline. None of these participants developed any other symptoms of hypotension. Of these participants, 1 had a history of AD.

Among the non-SCI rehabilitation outpatients, only 1 participant had an acute elevation in SBP of more than 20mmHg. This individual was a 72-year-old man with a history of stroke and hypertension who showed an elevation in SBP of 26mmHg immediately after the acupuncture treatment session. His medications included furosemide, which he would avoid taking immediately before his treatment session because of its diuretic effect. All other participants in this non-SCI group showed no change in SBP and DBP (table 3).

Table 2: Individual Changes in SBP

Participant	Session	AD History	ASIA	Level of Lesion	Pretreatment (Mean)	Change in SBP
A	4	No	A (complete)	T7	112/75	+20
B*	6	No	A (complete)	T7	130/76	+34
	9					+28
	10					+36
	12					+32
	13					+36
C	15	No	A (complete)	T8	109/67	+20
D	12	No	A (complete)	T4	124/71	−20
E	5	No	D (incomplete)	C3	150/88	−20
F	12	Yes	A (complete)	C4	96/62	−20

* History of hypertension; concurrently taking β-blockers.

DISCUSSION

AD is a serious and common complication of SCI at or above the T8 level. Fifteen participants with SCIs who were at risk for the development of AD were monitored for evidence of AD during an acupuncture analgesia study. During each of the 15 acupuncture sessions, none of the 15 participants reported any symptoms (including headache), consistent with a diagnosis of AD, though 3 presented a sign of AD (elevated BP). There were no episodes of other signs associated with AD, or clinical evidence of local skin infections or cellulitis.

On average, mean BP remained stable across the 15 sessions. Twelve of the 15 participants had no signs or symptoms of AD. Three individuals developed acute elevations in SBP of more than 20mmHg. These 3 participants did not have a history of AD. Two of them had 1 episode each of an acute increase in SBP and a third experienced 5 episodes. These 3 participants were classified as having ASIA A, T7- to T8-level injuries, and none had a history of AD. Interestingly, these were the only participants in the study with injuries at the T7 to T8 level. This pattern seems counterintuitive because the risk of AD is highest among those with injuries at or above T6.

Three other participants had individual episodes of a decrease in SBP of 20mmHg. This may be attributable to relaxation during treatments. None of these participants had other symptoms consistent with hypotension. There were no episodes of change in DBP of 20mmHg or more. None of the other 8 participants in the acupuncture analgesia study with lesions below T8 had any other abnormalities in BP.

The participant who experienced 5 episodes of acute elevations in SBP had a history of hypertension and was taking a β-blocker for the duration of the study. Although he exhibited increased SBP, he showed no symptoms consistent with the diagnosis of AD. It is unclear whether the increase in SBP was related to his hypertension, was a sign of AD, or was caused by other reasons. This participant also had a history of frequent urinary tract infections (UTIs) and was treated for a UTI during the first 4 sessions of the study. He had completed treatment for the UTI by the fifth session and the elevations in BP that were observed began in the sixth session of the study. It is unlikely but possible that the UTI contributed to his blood pressure elevations.

There were other patients who developed medical problems, such as an upper respiratory tract infection or UTI during the course of this study, but they did not develop signs or symptoms of AD. All 3 participants who developed the acute elevation in BP were monitored for an additional 30 minutes to ensure that their BP stabilized and that they did not develop any other symptoms of AD. This pattern of BP response is similar to the non-SCI group, with 1 patient who showed an acute elevation in SBP after acupuncture. This patient, like the participant in the SCI sample, had a history of hypertension that may have contributed to the BP elevation observed.

Table 3: BP Readings Taken Before and After a Single Acupuncture Treatment Session in a Group of Non-SCI Outpatients

Systolic (n = 20)		Diastolic (n = 20)	
Pretreatment	Posttreatment	Pretreatment	Posttreatment
125.15 ± 18.29	123.15 ± 22.26	76.05 ± 10.62	75.65 ± 11.15

NOTE. Values presented in mean mmHg ± SD.

CONCLUSION

Although the 15 participants in this study who were at risk for developing AD developed no symptoms consistent with this diagnosis, 3 patients displayed an acute elevation in SBP of 20mmHg or more, suggestive of imminent AD. Therefore, careful monitoring of patients with SCI during acupuncture treatments is advisable. This caution also appears to be advisable when treating those patients with hypertension whether or not they have an SCI. Monitoring BP and symptoms of AD should be a routine part of acupuncture treatments for those with SCIs above T8 both in research and clinical settings.

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References

1. Lindan R, Joiner E, Freehafer AA, Hazel C. Incidence and clinical features of autonomic dysreflexia in patients with spinal cord injury. Paraplegia 1980;18:285-92.
2. Kurnick NB. Autonomic hyperreflexia and its control in patients with spinal cord lesions. Ann Intern Med 1956;44:678-86.
3. Guttman L, Frankel H, Paeslack V. Cardiac irregularities during labor in paraplegic women. Paraplegia 1965;3:144-51.
4. Anson CA, Shepherd C. Incidence of secondary complications in spinal cord injury. Int J Rehabil Res 1996;19:55-66.
5. Cairns DM, Adkins RH, Scott MD. Pain and depression in acute traumatic spinal injury: origins of chronic problematic pain? Arch Phys Med Rehabil 1996;77:329-35.
6. Mariano AJ. Chronic pain and spinal cord injury. Clin J Pain 1992;8:87-92.

7. Rose M, Robinson JE, Ells P, Cole JD. Pain following spinal cord injury: results from a postal survey. Pain 1988;34:101-2.
8. Nepomuceno C, Fine PR, Richards JS, Gowens H, Stover SL, Rantanuabol U, et al. Pain in patients with spinal cord injury. Arch Phys Med Rehabil 1979;60:605-9.
9. DeLisa JA, Kirshblum S. A review: frustrations and needs in clinical care of spinal cord injury patients. J Spinal Cord Med 1997;20:384-90.
10. Lewis SM, Clelland JA, Knowles CJ, Jackson JR, Dimick AR. Effects of auricular acupuncture-like transcutaneous electric nerve stimulation on pain levels following wound care in patients with burns: a pilot study. J Burn Care Rehabil 1990;11:322-9.
11. Lu DP, Lu GP. Acupuncture anesthesia/analgesia for pain and anxiety control in dental practice. Part I: theory and Application. Compendium 1993;14:182-9.
12. Cheng R, McKibbin L, Roy B, Pomeranz B. Electroacupuncture elevates blood cortisol levels in naive horses: sham treatment has no effect. Int J Neurosci 1980;10:95-7.
13. White AR, Ernst EA. A systematic review of randomized controlled trials of acupuncture for neck pain. Rheumatology 1999; 38:143-7.
14. Anonymous. NIH Consensus Conference. Acupuncture. JAMA 1998;280:1518-24.
15. Berman BM, Hadhazy EJ, Swyers JP. Is acupuncture effective in the treatment of fibromyalgia? J Fam Pract 1999;48:213-8.
16. Stux G, Pomeranz B. Acupuncture: textbook and atlas. New York: Springer-Verlag; 1987.
17. Consortium for Spinal Cord Medicine. Clinical practice guidelines: spinal cord medicine. Acute management of autonomic dysreflexia: adults with spinal cord injury presenting to healthcare facilities. Washington (DC): Paralyzed Veterans of America; 1997.

Suppliers

a. Acupuncture needles; ITO-IMT, The Supply Center, 6829 Canoga Ave, Ste 5, Canoga Park, CA 91303.
b. Sphygmomanometer; Trimline Medical Products, 197 Meister Ave, Branchburg NJ 08876.