

Editorial

'Aqualisation' of neuraxis: Wondrous neuraqua CSF 1

Manu Kothari, Atul Goel

1

View and Review

Organization of neurology services in India: Unmet needs and the way forward

Mandaville Gourie-Devi

4

Original Articles

Endoscopic management of brain abscesses

Yad Ram Yadav, Mallika Sinha, Neha, Vijay Parihar

13

Pattern of cerebellar perfusion on single photon emission computed tomography in subcortical hematoma: A clinical and computed tomography correlation

Jayantee Kalita, Usha K. Misra, Prasen Ranjan, P. K. Pradhan

17

Imaging features in Hirayama disease

Hemant A. Sonwalkar, Rakesh S. Shah, Firosh K. Khan, Arun K. Gupta, Narendra K. Bodhey, Surjith Vottath, Sukalyan Purkayastha

22

Delayed habituation in Behcet's disease

Sefa Gulturk, Melih Akyol, Hulusi Kececi, Sedat Ozcelik, Ziyet Cinar, Ayse Demirkazik

27

Erythrocyte indicators of oxidative changes in patients with graded traumatic head injury

Chandrika D. Nayak, Dinesh M. Nayak, Annaswamy Raja, Anjali Rao

31

Repeat gamma knife radiosurgery for recurrent or refractory trigeminal neuralgia

Liang Wang, Zhen-wei Zhao, Huai-zhou Qin, Wen-tao Li, Hua Zhang, Jian-hai Zong, Jian-Ping Deng, Guo-dong Gao

36

Taste dysfunction in vestibular schwannomas

Rabi Narayan Sahu, Sanjay Behari, Vimal K. Agarwal, Pramod J. Giri, Vijendra K. Jain

42

Surgical management of traumatic intracranial pseudoaneurysms: A report of 12 cases

Xiang Wang, Jin-Xiu Chen, Chao You, Min He

47

Expression of truncated dystrophin cDNAs mediated by a lentiviral vector

Sun Shunchang, Chen Haitao, Chen Weidong, He Jingbo, Peng Yunsheng

52

Gamma knife radiosurgery for glomus jugulare tumors: Therapeutic advantages of minimalism in the skull base

Manish S. Sharma, A. Gupta, S. S. Kale, D. Agrawal, A. K. Mahapatra and B. S. Sharma

57

Case Reports

Subarachnoid hemosiderin deposition after subarachnoid hemorrhage on T2*-weighted MRI correlates with the location of disturbed cerebrospinal fluid flow on computed tomography cisternography	
<i>Yoshifumi Horita, Toshio Imaizumi, Yuji Hashimoto, Jun Niwa</i>	62
Anesthesia management of awake craniotomy performed under asleep-awake-asleep technique using laryngeal mask airway: Report of two cases	
<i>Gadhinglajkar Shrinivas Vitthal, Rupa Sreedhar, Mathew Abraham</i>	65
High cervical C3-4 'disc' compression associated with basilar invagination	
<i>Atul Goel</i>	68
Short-lasting unilateral neuralgiform headache with conjunctival injection and tearing: Response to antiepileptic dual therapy	
<i>Ravi Gupta, Manjeet S. Bhatia</i>	71
Correlation of autism with temporal tubers in tuberous sclerosis complex	
<i>Kavitha Kothur, Munni Ray, Prahbjot Malhi</i>	74
Non-traumatic carotid dissection and stroke associated with anti-phospholipid antibody syndrome: Report of a case and review of the literature	
<i>Benzi M. Kluger, Richard L. Hughes, C. Alan Anderson, Kathryn L. Hassell</i>	77
Osteoma of anterior cranial fossa complicated by intracranial mucocoele with emphasis on its radiological diagnosis	
<i>Jinhu Ye, Hui Sun, Xin Li, Jianping Dai</i>	79
Vasospasm after transsphenoidal pituitary surgery: A case report and review of the literature	
<i>Manish Kumar Kasliwal, Ravinder Srivastava, Sumit Sinha, Shashank S. Kale, Bhawani S. Sharma</i>	81
Chondromyxoid fibroma of the seventh cervical vertebra	
<i>Ashish Jonathan, Vedantam Rajshekhar, Geeta Chacko</i>	84
Acute progressive midbrain hemorrhage after topical ocular cyclopentolate administration	
<i>Tarkan Calisaneller, Ozgur Ozdemir, Erkin Sonmez, Nur Altinors</i>	88

Letters to Editor

Digital subtraction angiography laboratory with inbuilt CT (DynaCT): Application during intracranial aneurysm embolization	90
Concomitant tuberculous and pyogenic cerebellar abscess in a patient with pulmonary tuberculosis	91
Drug compliance after stroke and myocardial infarction: Is complementary medicine an issue?	93

Multiple intracranial developmental venous anomalies associated with complex orbitofacial vascular malformation	93
Nitrofurantoin-induced peripheral neuropathy: A lesson to be re-learned	94
Posterior longitudinal ligament cyst as a rare cause of lumbosacral radiculopathy with positive straight leg raising test	96
Aqueductal stenosis caused by an atypical course of a deep collector vein draining bilateral cerebellar developmental venous anomalies	97
Recovery of increased signal intensity of the cervical cord on magnetic resonance imaging after surgery for spontaneous spinal epidural hematoma causing hemiparesis	98
Simultaneous thalamic and cerebellar hypertensive hemorrhages	100

Neuroimages

MRI and MRA in spontaneous intracranial arterial dissection <i>S. Raghavendra, Sanjeev V. Thomas, Krishnamoorthy Thamburaj, Bejoy Thomas</i>	102
Shunt catheter migration into pulmonary arteries <i>Miikka Korja, Matti K. Karvonen, Arto Haapanen, Reijo J. Marttila</i>	103
Susceptibility weighted imaging in holohemispheric venous angioma with cerebral hemiatrophy <i>Sivaraman Somasundaram, Chandrasekharan Kesavadas, Bejoy Thomas</i>	104

Forthcoming Events	105
--------------------------	-----

Instructions to Authors	106
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Referees List - 2007	000???
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Delayed habituation in Behcet's disease

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Background: The autonomic nervous system in Behcet's patients may be affected due to various reasons. This entity may be detected with the measurement of the electrodermal activities, heart rate variability and pupillometric methods. Habituation is one of the implicit forms of learning and memory and the loss of habituation can reveal pathological changes in the synaptic regions. **Aim:** To determine whether there is a functional decrease in the synaptic effectiveness (habituation) of the pathways to sympathetic neurons that had been repeatedly activated in Behcet's. **Materials and Methods:** Twelve patients with Behcet's disease and 12 healthy controls were included in the study. Sympathetic skin potential (SSP) records were taken at normal room temperature in a quiet place within a Faraday cage. Sixteen square wave single shock impulses (duration: 1200 μ s, strength: 5 mA) were applied on each case. **Results:** After the 1st stimulus, the SSP amplitudes were lower in the patients compared to the controls ($P < 0.001$, t value = 7.69). There was no significant differences among the SSP amplitudes after the 13th impulse in the patients ($P > 0.05$). Whereas there was no significant differences among the SSP amplitudes after the 9th impulse in the controls ($P > 0.05$). The habituation rate of the SSP after consecutive impulses was slowest in the patients compared to controls ($P < 0.001$, t value = 12.39). **Conclusions:** There is a delayed habituation in Behcet's disease and that may due to pathologic changes with vasculitis through their peripheral nerves.

Key words: Autonomic nervous system, Behcet's disease, habituation, sympathetic skin potentials

Neuro-Behcet's disease (BD) is a motor-mental disorder usually affecting the brainstem and basal ganglions.^[1] In some cases without neurological manifestations, there is a possibility of subclinic involvement which can be detected by various methods, including single photon emission computed tomography (SPECT), brain stem auditory evoked potentials (BAEP), visual evoked potentials (VEP), motor evoked potentials (MEP), and P300.^[2] The autonomic nervous system (ANS) in Behcet's disease had been evaluated with the measurement of

the electrodermal activities, the hearth rate variability, and pupillometric studies.^[3,4] Cognitive, emotional, and physical behaviors involve changes in peripheral autonomic activity. The phenomenon of electrodermal activity (EDA) is accepted as an indirect indicator of the sympathetic nervous system.^[5] The sympathetic skin response (SSR) is a polysynaptic reflex associated with the activation of sweat glands. The SSR is most evident when recorded from the palmar and plantar sites, where there is a larger concentration of eccrine glands. The afferent component may be activated by nonspecific sensory stimuli. The central processing circuitry is predominantly represented by cerebral structures, under strong influence of consciousness, emotions and cognitive activity.^[6] The efferent component of the reflex consists of sympathetic-cholinergic fibers from the paravertebral sympathetic chain of the central nervous system (CNS) to sweat glands. In human lesion deficit models with post-ganglionic sympathetic denervation (pure autonomic failure) the SSR cannot be elicited.^[7]

Habituation is the simplest form of implicit learning.^[8] Depression of the connections made by sensory or interneurons or both, seems to be a fairly common mechanism of habituation.^[8] The loss of habituation can be shown in some neurological disorders, including migraine and may reveal pathologic changes in the synaptic regions of peripheral nerves. In this study, the loss of habituation in Behcet's patients has been investigated with the measurement of the sympathetic skin potentials (SSPs) against consecutive nerve stimulation.

Materials and Methods

We compared measures of electrodermal activity in 12 subjects with Behcet's disease with those of 12 healthy controls. Twelve patients with Behcet's disease admitted to our Dermatology service were accepted for the study. All patients met criteria established by the International Study Group for Behcet's disease.^[9] Control subjects, age-sex-matched, were healthy and without history of

neurological, psychiatric diseases or sweating disorders. Exclusion criteria for the patients included neurological or psychiatric disorders orthostatic hypotension, eccrine sweating defects, sphincter disorders, presence of any lesion in magnetic resonance of brain and use of any drugs at least in the last two weeks.

Records were taken from the right arm in a supine position at normal room temperature ($20 \pm 2^\circ\text{C}$) in a quiet place under dim light within a Faraday cage with sound insulation. Minimally unpolarized Ag/AgCl electrodes were attached to the hypothenar blister of the hand and two-thirds upper portion of the inside of the forearm.^[4] The electrodes were fixed after the inside of the forearm was cleaned with a piece of cotton, dipped in alcohol and then the skin resistance was decreased by removing the stratum corneum by the use of a fine sandpaper. In this manner, the connection part of the inactive reference electrode was determined. For the amplification, Nihon Kohden's AA-600 H model was used and the records were kept in DC mode. For the electrical stimulation of the left ulnar nerve, silver EEG electrodes (inner caliber: 9 nm) were used. Sixteen consecutive square wave shock impulses (duration: 1200 μs , strength: 5 mA) were applied on each volunteer. Nihon Kohden Ag/AgCl electrodes with inner caliber of 7 mm were used as the skin potential recording electrodes.

After connecting the electrodes to the subjects, they were informed about the experimental conditions and 10 min were allowed for their adaptation to these conditions as well as their skins' adaptation to the mean of records which occurred after three electrical stimuli in each session. Moving ranges of two stimuli (delta SSP 1-15) were calculated by subtractions of SSP at the S2-S16 from those at S1-S15, respectively.

Age, sex, duration of disease and SSPs at the S1-S16 of Behcet's patients and controls were analyzed with *t*-test. The amplitudes of SSP at the S1-S16, delta SSPs at the S1-S15 and the latencies of SSP at the S1-S16 were analyzed with repeated-measures ANOVA test followed by post hoc Tukey test.

Results

We compared measures of electrodermal activity in 12 subjects (48.8 ± 8.5 years) with Behcet's disease with those of 12 healthy controls (six women and six men, mean age 29.7 ± 4.2 years) following the first and 16th stimuli. In controls, the mean amplitude of the SSPs decreased from 4.9 ± 0.3 mV at the first stimulus to 0.8 ± 0.1 mV at the 16th stimulus ($P < 0.001$, *t*-value: 27.37). In Behcet's patients, the mean amplitude of the SSPs decreased from 4.1 ± 0.2 mV at the first stimulus to 0.8 ± 0.1 mV at the 16th stimulus ($P < 0.001$, *t*-value: 44.52) [Figure 1]. There was a significant difference

in mean amplitudes of SSP especially after the first stimulus between patients and controls (respectively; mean: 4.1, SD: 0.2; mean: 4.9, SD: 0.3; $P < 0.001$, *t*-value = 7.69). In controls, at the first, second, and third stimuli, the mean amplitudes of SSP were higher than those of Behcet's patients ($P < 0.001$, *t*-value = 7.69; $P < 0.001$, *t*-value = 5.80; $P = 0.04$, *t*-value = 2.16; respectively) [Figure 2]. The difference in habituation rate of the SSP after the 13th stimulus was not significant in the patients' group ($P > 0.05$) [Figure 3]. However, in controls, the difference in habituation rate of the SSP after the ninth stimulus was not significant ($P > 0.05$)

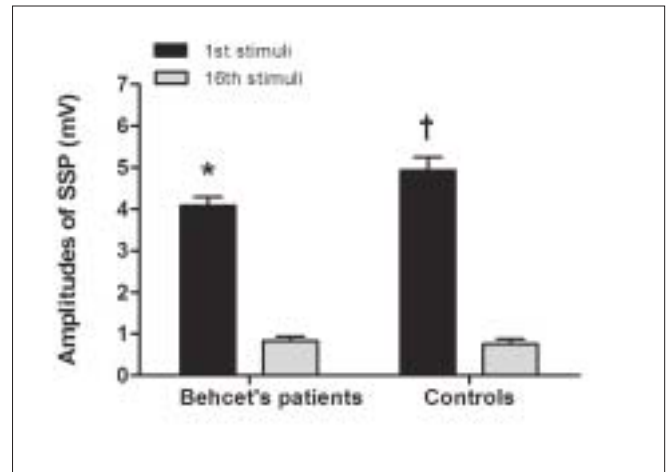


Figure 1: Mean amplitudes of sympathetic skin potential (Mean SSP) at the 1st and 16th stimuli in Behcet's patients ($n=12$) and controls ($n=12$). In controls, the mean amplitude of the SSPs decreased from 4.9 ± 0.3 mV at the first stimulus to 0.8 ± 0.1 mV at the 16th stimulus ($P < 0.001$, *t*-value: 27.37). In Behcet's patients, the mean amplitude of the SSPs decreased from 4.1 ± 0.2 mV at the first stimulus to 0.8 ± 0.1 mV at the 16th stimulus ($P < 0.001$, *t*-value: 44.52) * $P < 0.001$ vs. at the 16th stimuli of the Behcet's patients. † $P < 0.001$ vs. at the 16th stimuli of controls

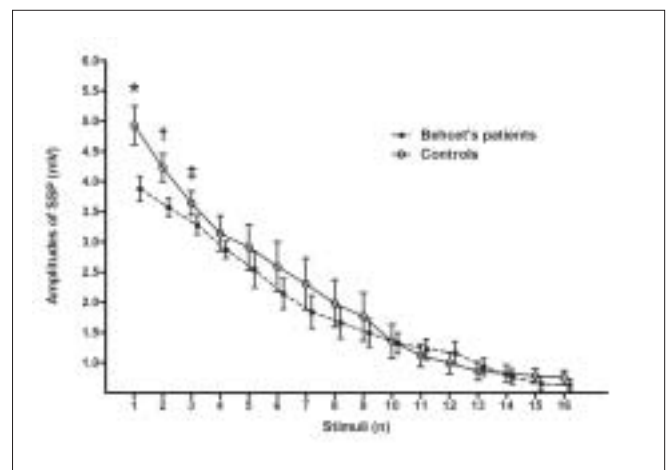


Figure 2: Amplitudes of sympathetic skin potential (SSP) from a series of 16 stimuli to the left ulnar nerve in Behcet's patients ($n=12$) and controls ($n=12$). In controls, at the 1st, 2nd, and 3rd stimuli, the mean amplitudes of SSP were higher than those of Behcet's patients (respectively; $P < 0.001$, *t*-value=-7.69, $P < 0.001$, *t*-value=-5.80, $P = 0.04$, *t*-value=-2.16). Statistical evaluation was analyzed with *t*-test. Data were presented as means \pm S.D. * $P < 0.001$, † $P < 0.001$, ‡ $P = 0.04$ vs. Behcet's patients

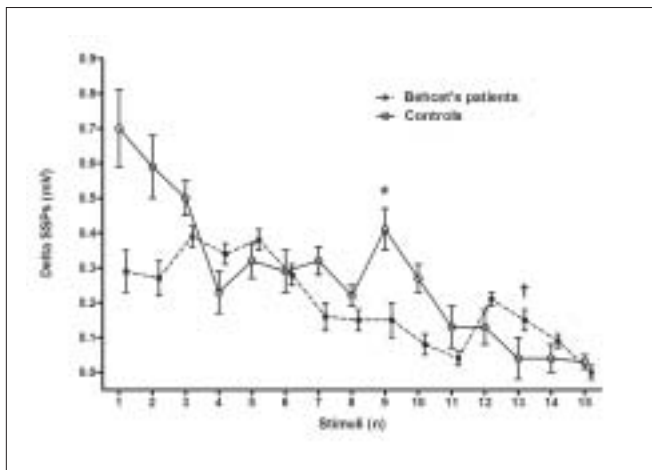


Figure 3: Delta SSPs of two consecutive stimuli for Behcet's patients ($n=12$) and controls ($n=12$). * $P>0.05$ for controls, no significant difference between the sympathetic skin potentials after the 9th stimuli. † $P>0.05$ for patient group, no significant difference between the sympathetic skin potentials after the 13th stimuli

[Figure 3]. The mean habituation rate of the SSP increased in the patients' group compared to controls ($P<0.001$, t -value = 12.39) [Figure 3]. We found no significant difference between the patients and controls with regard to the latency values of SSP (in controls, mean: 2.1, SD:0.2; in patients, mean: 2.2, SD:0.1, $P>0.05$).

Discussion

Since CNS involvement was first described, it is well known to occur in BD. Areas of focal inflammation can occur at different levels of the CNS. The brainstem, cerebral hemispheres, cerebellum, spinal cord and meninges are the common sites of CNS involvement.^[10] The CNS changes in three cases of neuro-Behcet's disease were observed by computed tomography (CT), magnetic resonance (MR) and single photon emission computed tomography (SPECT).^[11] Unlike other vasculitides, the involvement of the peripheral nervous system is a rare condition.^[12] Although silent neurological involvement may occur in BD, the most common neurological symptoms or signs are related to pyramidal tract involvement.^[13] Behcet's disease may have asymptomatic ANS dysfunction, which is in the form of increased sympathetic and decreased parasympathetic modulation.^[3] In patients with nervous system diseases, motor and sensory defects may be the more pronounced complaints. The ANS might also be involved as autonomic system disorders may be accompanied by motor and sensory dysfunctions in peripheral diseases or CNS disorders.

The SSPs reflect the integrity of the small unmyelinated autonomic fibers, pathways not tested by routine nerve conduction studies of motor and sensory nerves. Skin potential level has two mechanisms of generation: that

due to sweat gland activity (sudorific) and that due to other causes (nonsudorific).^[14] The ANS may be assessed by measuring electrodermal activities.^[3] Because there may be vasculitic changes in multiple brain regions in Behcet's disease, it may be speculated that decreased sympathetic activity in our patients may due to the fact a possible subclincic abnormality of the ANS.

Habituation is the simplest form of implicit learning. It was due to a functional decrease in the synaptic effectiveness of the pathways to the motor neurons that had been repeatedly activated. The decrease in synaptic transmission in the sensory neurons results from a decrease in the amount of the chemical transmitter (glutamate) released from the presynaptic terminal.^[8] The biochemical base of habituation is still not known. However, the decrease of protein kinases due to the repetitive stimuli may exist in habituation. The role of adrenergic and serotonergic systems may be important and some transmitters, including acetylcholin, noradrenalin, dopamine, nitric oxide, abitation of skin responses is more probably related to the activity of peripheral sweat glands activated by the efferent sympathetic fibers. The process might be influenced by adaptation at the level of the sweat glands as well as ANS.^[5] This is associated with decreased release of neurotransmitter from the presynaptic terminal because of decreased intracellular Ca^{2+} .^[16] The decrease in intracellular Ca^{2+} is owing to a gradual inactivation of Ca^{2+} channels. It can be short-term or it can be prolonged if exposure to the benign stimulus is repeated many times.

In conclusion, the finding that the skin potential habituation rate of Behcet's patients was lower than the controls has a consistency with similar research. We emphasize that symptoms of autonomic disturbance must be evaluated carefully for a possible involvement of ANS, even in patients with no orthostatic hypotension, eccrine sweating defects, sphincter disorders, pyramidal signs, deep tendon reflex abnormalities or sensory disturbances. It may be speculated that the delayed habituation in Behcet's disease results from the pathologic changes in the synaptic regions of peripheral nerves. The decreased SSP and delayed habituation may be a sign of the involvement of the peripheral nerves in Behcet's disease.

References

1. Eguia A, Villarreal M, Martinez-Conde R, Echebarria MA, Aguirre JM. Adamantides-Behcet disease: An enigmatic process with oral manifestations. *Med Oral Patologia Oral Y Cirugia Bucal* 2006;11:E6-11.
2. Karatas GK, Onder M, Meray J. Autonomic nervous system involvement in Behcet's disease. *Rheumatol Int* 2002;22:155-9.
3. Aksoyek S, Aytemir K, Ozer N, Ozcebe O, Oto A. Assessment of autonomic nervous system function in patients with Behcet's disease by spectral analysis of heart rate variability. *J Auton Nerv Syst* 1999;77:190-4.
4. Kececi H, Kavak A, Akyol M, Degirmenci Y, Anul H. Habituation of auditory event-related potentials in patients with Behcet's disease. *Neurol*

- Sci 2004;25:257-63.
5. Cariga P, Catley M, Mathias CJ, Ellaway PH. Characteristics of habituation of the sympathetic skin response to repeated electrical stimuli in man. *Clin Neurophysiol* 2001;112:1875-80.
 6. Critchley HD, Elliott R, Mathias CJ, Dolan RJ. Neural activity relating to generation and representation of galvanic skin conductance responses: A functional magnetic resonance imaging study. *J Neurosci* 2000;20:3033-40.
 7. Magnifico F, Misra VP, Murray NM, Mathias CJ. The sympathetic skin response in peripheral autonomic failure—evaluation in pure failure, pure cholinergic dysautonomia and dopamine-beta-hydroxylase deficiency. *Clin Auton Res* 1998;8:133-8.
 8. Glanzman DL. The cellular mechanisms of learning in Aplysia of blind men and elephants. *Biol Bull* 2006;210:271-9.
 9. Criteria for diagnosis of Behcet's disease. International Study Group for Behcet's Disease. *Lancet* 1990;335:1078-80.
 10. Yazici H, Yurdakul S, Hamuryudan V. Behcet's syndrome. *Curr Opin Rheumatol* 1999;11:53-7.
 11. Mizukami K, Shiraishi H, Tanaka Y, Terashima Y, Kawai N, Baba A, *et al.* CNS changes in neuro-Behcet's disease: CT, MR and SPECT findings. *Comput Med Imaging Graph* 1992;16:401-6.
 12. Namer IJ, Karabudak R, Zileli T, Ruacan S, Kucukali T, Kansu E. Peripheral nervous system involvement in Behcet's disease: Case report and review of the literature. *Eur Neurol* 1987;26:235-40.
 13. Akman-Demir G, Baykan-Kurt B, Serdaroglu P, Gürvit H, Yurdakul S, Yazici H, Bahar S. *et al.* Seven-year follow-up of neurologic involvement in Behcet syndrome. *Arch Neurol* 1996;53:691-4.
 14. Donofrio PD. Electrophysiologic evaluations. *Neurol Clin* 2000;18:601-13.
 15. Schoenen J. Cortical electrophysiology in migraine and possible pathogenetic implications. *Clinical neuroscience*. New York, NY; 1998. 5. p. 10236.
 16. Nistratova VL, Pivovarov AS. Inositol triphosphate and ryanodine receptors in the control of the cholin sensitivity of common snail neurons by the Na,K pump during habituation. *Neurosci Behav Physiol* 2005;35:699-708.

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