

Hyperhidrosis Due to Thalamic Deep Brain Stimulation in a Patient with Essential Tremor

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ABSTRACT

OBJECTIVE: We present a unique case of hyperhidrosis as a side effect of Vim (ventrointermedius) deep brain stimulation.

BACKGROUND: Essential tremor (ET) is the most common form of tremor encountered in movement disorder clinics. ET is characterized by postural and action tremor of the upper extremities, but head, voice, and lower extremity tremors may also be present. For medication-resistant patients, high frequency stimulation of the thalamus is a viable therapeutic alternative. Side effects of DBS include, but are not limited to paresthesias, gait difficulty, dysarthria, and dystonia. We present a unique case of hyperhidrosis as a side effect of Vim-DBS.

METHODS: The patient is a 76 year-old, right-handed male who developed intermittent right hand action tremor at the age of 71 when reaching for objects. In time, he developed a mild action tremor in the left hand. The tremor gradually progressed to interfere with activities of daily living. He responded poorly to medications and was referred to our facility for evaluation of DBS. Examination revealed a postural and kinetic tremor in the right greater than left hand. There was no tremor in the bilateral lower extremities, head, or voice. The patient underwent left Vim-DBS without complications. During postoperative programming sessions, the patient developed profuse, left-sided hyperhidrosis. He denied abnormal sweating prior to programming sessions.

RESULTS: For localization, stimulation parameters remained constant: 2.5V, frequency 185Hz, pulse width 120µsec, and case positive. Using contacts 0, 2, and 3, no sweating occurred. Within seconds of activating contact 1, the patient developed profuse sweating of the left face, thorax, and arm. Magnetic resonance imaging of the brain confirmed lead positioning in the thalamus with a slightly inferior displacement extending to the superior cerebral peduncle.

CONCLUSIONS: Although a rare complication, hypothalamic dysfunction can occur as a stimulation-related side effect of Vim-DBS. In our patient, DBS possibly resulted in unilateral activation of the anterior hypothalamus, modified afferent thalamic-hypothalamic or efferent sympathetic pathways to the brainstem resulting in ipsilateral hyperhidrosis.

INTRODUCTION

Essential tremor (ET), the most common form of tremor encountered in movement disorder clinics, is characterized by postural and action hand tremor but head, voice, and other tremors may also be present. For patients with ET who are medication resistant, high frequency deep brain stimulation (DBS) of the thalamic ventrointermedius (Vim) nucleus is a viable therapeutic alternative resulting in 50-100% improvement in extremity tremor, with head and voice tremor showing less robust improvement. Direct side effects of DBS stimulation include paresthesias, dysarthria, disequilibrium, and dystonia. We present a unique case of hyperhidrosis as a side effect of Vim-DBS.

METHODS/RESULTS

➤ A 76 year-old right handed man presented with progressive action tremor of the right hand for five years.

➤ He later developed a head tremor in the horizontal plane and action tremor in the left hand.

➤ The bilateral hand tremor gradually interfered with activities of daily living. Examination showed postural and action tremor in right greater than left hand.

➤ Because his tremor interfered with activities of daily living and failed to respond to propranolol, he underwent left Vim-DBS.

➤ He had no intra- or immediate post-operative complications, but during programming sessions he was noted to have profuse, left sided sweating.

➤ Various combinations of stimulating parameters were employed to alleviate the hyperhidrosis; when contacts 0, 2 and 3 were used, the sweating resolved.

➤ Within seconds of activating contact 1, he developed profuse sweating of the left hemi-body visualized with a mixture of corn starch and providone iodine (Figure 1, top).

➤ Optimal tremor control without hyperhidrosis was achieved with contact 0.

➤ Neurostimulation parameters remained constant after the initial programming session: amplitude 2.5V, frequency 185 Hz, pulse width 120 µsec, case positive, and electrode 0 negative.

➤ Magnetic resonance imaging of the brain showed electrode placement in the left anterior thalamus traversing the hypothalamus (Figure 1, bottom) with the tip of the electrode extending caudally into the upper midbrain.

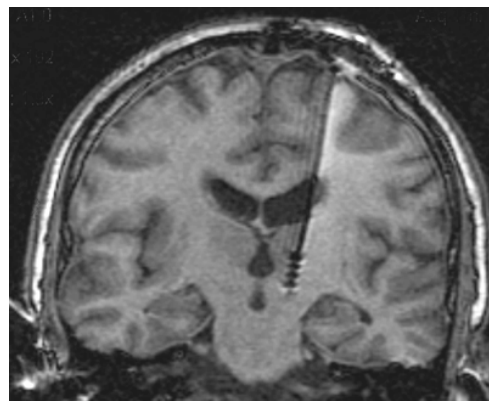


Figure (Top) Left hemi-body hyperhidrosis visualized with a mixture of corn starch and providone iodine during stimulation of left Vim-DBS. (Bottom) Magnetic resonance imaging of the brain showing deep brain stimulator electrode placement in the left anterior thalamus traversing the hypothalamus.

DISCUSSION

Thermosensitive neurons are located in the preoptic area of the anterior hypothalamus and descend uncrossed through the medial portion of the lateral funiculus of the brainstem to synapse with preganglionic sympathetic neurons of the interomedial lateral column of the spinal cord. Based on animal anatomical studies, sympathetic neurons and outflow tracts have been found to involve the A5 noradrenergic cell group, paraventricular hypothalamus, caudal raphe region, rostral ventrolateral medulla, ventromedial medulla, and the ventral zona incerta. Structural lesions resulting in unilateral hyperhidrosis have been described following cortical, subcortical, brainstem and hypothalamic infarcts, syringomyelia, multiple sclerosis, and neurosurgical procedures (Table).

CONCLUSIONS

• In our patient, high frequency DBS possibly resulted in unilateral activation of the anterior hypothalamus or efferent sympathetic pathways to the brain stem resulting in ipsilateral hyperhidrosis.

• Our report demonstrates that, although a rare complication, hypothalamic dysfunction may occur as a stimulation-related side effect of Vim-DBS.

REFERENCES

Table Central nervous system lesions causing hyperhidrosis

AUTHOR	YEAR	LESIONS CAUSING HYPERHIDROSIS
Labar et al ⁷	1988	Right MCA infarct Left MCA infarct Left frontal-opercular infarct Right opercular infarct
Kim et al ⁸	1995	Left MCA infarct Right PCA infarct Right lateral medullary infarct Left lateral medullary infarct
Rousseaux et al ⁹	1996	Right lateral medullary infarct Left lateral medullary infarct
Smith ¹⁰	2001	Right posterior hypothalamic infarct
Ueno ¹¹	2000	Left hypothalamus demyelination (Multiple sclerosis)
Carmel ¹²	1968	Right thalamotomy Left thalamotomy
Kim ¹³	1972	Right Subthalamotomy Left Subthalamotomy

- Louis ED. Essential tremor. *Lancet Neurol* 2005;4(2):100-110.
- Pathwa R, Lyons KE, Wilkinson SB, et al. Long-term evaluation of deep brain stimulation of the thalamus. *J Neurosurg* 2006;104(4):506-512.
- Ondo W, Jankovic J, Schwartz K, Almaguer M, Simpson RK. Unilateral thalamic deep brain stimulation for refractory essential tremor and Parkinson's disease tremor. *Neurology* 1998;51(4):1063-1069.
- Hamm H, Naumann MK, Kowalski JW, Kurt S, Kozma C, Tesile C. Primary focal hyperhidrosis: disease characteristics and functional impairment. *Dermatology* 2006;212(4):343-353.
- Strack AM, Sawyer WB, Hughes JH, Platt KB, Loewy AD. A general pattern of CNS innervation of the sympathetic outflow demonstrated by transneuronal pseudorabies viral infections. *Brain Res* 1989;491(1):156-162.
- Loewy AD. Forebrain nuclei involved in autonomic control. *Prog Brain Res* 1991;87:253-268.
- Labar DR, Mohr JP, Nichols FT, 3rd, Tatemichi TK. Unilateral hyperhidrosis after cerebral infarction. *Neurology* 1988;38(11):1679-1682.
- Kim BS, Kim YI, Lee KS. Contralateral hyperhidrosis after cerebral infarction. Clinicoanatomic correlations in five cases. *Stroke* 1995;26(5):896-899.
- Rousseaux M, Hurtvert JF, Benaim C, Cassim F. Late contralateral hyperhidrosis in lateral medullary infarcts. *Stroke* 1996;27(5):991-995.
- Smith CD. A hypothalamic stroke producing recurrent hemihyperhidrosis. *Neurology* 2001;56(10):1394-1396.
- Ueno M, Tokunaga Y, Terachi S, Gondok K, Hara T. Asymmetric sweating in a child with multiple sclerosis. *Pediatr Neurol* 2000;23(1):74-76.
- Carmel PW. Sympathetic deficits following thalamotomy. *Arch Neurol* 1968;18(4):378-387.
- Kim YK, Umbach W. The effects of stereotaxic subthalamotomy on sympathetic tonus. *Confin Neurol* 1972;34(2):156-161.
- Thornton JM, Aziz T, Schlugman D, Paterson DJ. Electrical stimulation of the midbrain increases heart rate and arterial blood pressure in awake humans. *J Physiol* 2002;539(Pt 2):615-621.
- Lipp A, Tank J, Trottenberg T, Kupsch A, Arnold G, Jordan J. Sympathetic activation due to deep brain stimulation in the region of the STN. *Neurology* 2005;65(5):774-775.