

Treatment-Induced Delusions of Infestation Associated with Increased Brain Dopamine Levels

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Accepted Nov 20, 2018; Epub ahead of print Nov 21, 2018

Delusional infestation (DI) is defined as a fixed and false belief of a skin infestation by a pathogen. Although primarily a psychiatric condition, dermatologists see the majority of these challenging patients (1). Herein, we present 3 patients with symptoms mimicking those of DI, all caused by medical treatments increasing dopaminergic activity.

CASE REPORTS

Case 1. A 70-year-old woman with a history of Parkinson's disease presented with episodes of "bugs" crawling on her skin causing severe itch. These episodes would last several hours. However, after the episodes subsided and her itch disappeared the patient would gain insight and realize that these were not real bugs after all.

Her past medical history was significant for 4 years of Parkinson's disease, for which she had suffered severe tremors and levodopa dyskinesia, requiring deep brain stimulation (DBS) of the subthalamic nucleus. After surgery for DBS, her levodopa dose was reduced and after two months, her levodopa dyskinesia and tremors were improved. However, her DBS device required reprogramming several times during the next year due to electronic failure. It was after the reprogramming of her device that the patient would experience these feelings of bugs crawling on her skin.

The patient denied use of any recreational drugs, opiates, or painkillers. On physical examination, she had no additional neurologic deficits besides her Parkinson's disease. She had excoriations bilaterally on her arms, but otherwise no abnormal skin findings. MRI of her brain did not show any evidence of stroke or pathology. Her electrolytes, blood sugar levels, and vitamin B12 were within normal limits.

Psychiatric evaluation was obtained and did not demonstrate any psychopathology. After several months and appointments with neurology, and after no additional DBS reprogramming, the episodes of bugs crawling on her skin fully resolved.

Case 2. A 70-year-old woman presented with complaints of a "bug infestation" for one year. She reported that it began with a scabies infestation 15 months earlier, which had not cleared despite several courses of topical permethrin cream and oral ivermectin. She presented with the classic specimen sign (2), demonstrating several pieces of feces and skin that she felt were "bugs".

Her past medical history was significant for restless leg syndrome, treated with 1 milligram (mg) of ropinirole, a dopamine agonist, for 3 years. However, over a year ago, she independently decided to increase her dose of ropinirole to 2 mg, which she had since maintained.

On physical examination she was alert and oriented, with slightly pressured speech and emotional lability. She had numerous excoriations, hyperkeratotic papules and scars on her extremities, chest, upper back, buttocks, and thighs. Extensive lab testing for vitamin deficiency, thyroid disease, and metabolic abnormalities were within normal limits.

The patient was diagnosed with delusional infestation secondary to ropinirole. She was urged to stop the ropinirole, but due to her concern of worsening her restless leg syndrome, she agreed to start by titrating the dose down to 1 mg, which resulted in improvement

of her symptoms. One month later, she discontinued ropinirole and started pregabalin 75 mg twice a day for treatment of her restless leg syndrome. After one week, she had complete resolution of her delusional infestation.

Case 3. A 62-year-old man with a history of attention deficit hyperactivity disorder (ADHD) presented with complaints of scabies in his scalp for the past 8 months. He described scabies "burrowing into his scalp, and moving" and seeing scabies' eggs "raining" from his scalp. He had been treated with multiple courses of ivermectin and permethrin cream with no resolution, and had started self-treatment by applying malathion to his scalp.

His past medical history was significant for a 30-year history of ADHD, treated with dextroamphetamine/amphetamine 120 mg daily (3-fold greater than the recommended maximum dosage of 40 mg for treatment of ADHD). Additionally, he was taking armodafinil, a dopamine reuptake inhibitor, 250 mg daily for "sleepiness during the day".

On physical examination, he had normal affect and pleasant mood. His scalp showed erythema, with pink eczematous patches extending onto the frontal forehead as well as on the tops of the pinnae. There was no evidence of nits or lice noted. Over his chest, upper back, arms, and ankles he had excoriations and pink scaly patches.

Based on his history and physical exam, he was diagnosed with DI, secondary to armodafinil and dextroamphetamine/amphetamine, and a contact dermatitis. He was advised to stop applying permethrin, malathion, and hair dyes to his scalp, and was given topical steroids that resolved his contact dermatitis. Most importantly, his psychiatrist was consulted and armodafinil was discontinued and dextroamphetamine/amphetamine was weaned to 60 mg daily.

At follow-up one month later, the patient's delusional state had totally resolved and his excoriations and rashes improved significantly.

DISCUSSION

Pathophysiology of DI is unknown, although a compelling theory suggests dopamine as a major player in its manifestation. Huber et. al. (3) proposed a mechanism of DI involving dysfunction of the dopamine transporter (DAT), which acts to regulate the level of dopamine in the brain by removing it from the extracellular space. If DAT is malfunctioning, the level of dopamine at the synaptic cleft increases. DAT is located at the presynaptic nerve terminal and has a dense distribution in the striatum, specifically the putamen (3, 4).

Interestingly, this fronto-striato-thalamo-parietal network has been associated with DI and overlaps with the striato-thalamo-orbitofrontal circuit that is enhanced in chronic itch (5). Therefore, an increased level of dopamine activating this circuit may explain why these patients feel sensations of itch and desires to scratch.

In all 3 cases, treatments that increased dopamine levels in the brain caused symptoms of delusional infestation. Case 1 was a Parkinson's patient undergoing DBS. Parkinson's disease has been previously reported to cause secondary DI due to the use of dopaminergic medications (6, 7). However, to our knowledge, no cases have been reported of DBS causing symptoms of DI. The mechanism of DBS is poorly understood, but some evidence shows that electrical stimulation of the subthalamic nucleus, which has neuronal projections to the substantia nigra, leads to activation of surviving nigrostriatal neurons, which leads to increased dopamine release in the striatum (8). Perhaps after each DBS device reprogramming, the patient experienced a brief hyperdopaminergic state, leading to these delusions. Unlike other cases of DI, our patient would regain insight immediately following each episode.

In case 2, ropinirole, a dopamine agonist, is another medication altering the effect of dopamine at the synaptic cleft. It directly stimulates the dopamine receptors at the postsynaptic nerve terminal and has been reported in cases of DI (6).

Case 3 was taking a dose of dextroamphetamine/amphetamine that was 3-fold the FDA recommended maximum dose. Dextroamphetamine/amphetamine reverses the action of DAT, causing dopamine to flow into the extracellular space (9). Armodafinil, the R-isomer of modafinil, also affects dopamine by blocking DAT, leading to an increase of dopamine in the brain (10). Although, to our knowledge, there are no reported cases of armodafinil or modafinil causing DI, their binding to DAT overlaps with the binding site of cocaine, which has been implicated in cases mimicking DI (10).

In summary, these 3 cases illustrate that drugs and treatments increasing dopamine can cause a somatic response resembling delusional infestation. Dermatologists should be aware of these associations.

ACKNOWLEDGEMENT

We would like to thank the patients for granting permission to publish this information.

Conflicts of Interest: GY has been a consultant or Ad Board member of Menlo, TREVI, Sienna, Galderma, Sanofi, Novartis, Eli Lilly, Pfizer and received research grants from Sun Pharma, Pfizer, Leo Foundation.

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