Case Report
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The Accompanying Changes in Brain Structure of a Remitted Depression Patient with the Bupropion Treatment

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The impacts from the bupropion on the brain structures have seldom been mentioned in the literature. The bupropion is a kind of antidepressant with dual action in the norepinephrine and dopamine receptors. Here we have a case to share about the bupropion-related effects in the brain structure.

KEY WORDS: Bupropion; Brain volume; Gray matter volume; White matter volume.

INTRODUCTION

The effects of the antidepressant bupropion on brain structures have seldom been reported. Bupropion has a dual action on norepinephrine and dopamine receptors. Here, we report a case showing bupropion-related effects on the brain structure.

CASE

A woman visited our clinic, who is a first-episode medication-naïve depression patient with a three-month history of depressed mood, suicidal ideation, lack of energy, feelings of worthlessness, psychomotor agitation, and significantly impaired occupational function (Hamilton Rating Scale for Depression [HRSD] score of 29). She had no other psychiatric or medical co-morbidities. Bupropion treatment (150 mg/day) was initiated on her first visit to my clinic; her depression symptoms responded in the second week (bupropion 300 mg/day; HRSD score 19) and she entered remission at six weeks (bupropion 300 mg/day; HRSD score 7). Her social and occupational function significantly improved (HRSD work and activities item scores 4 → 1). No significant side effects or body weight changes were noted. She underwent three-dimensional fast spoiled gradient-echo recovery T1-weighted magnetic resonance imaging at baseline and six weeks after treatment initiation on a 3T Siemens scanner. We used the SIENA function (Structural Image Evaluation, using Normalization, of Atrophy) of the FMRIB software library toolbox (Oxford University) to analyze brain changes at a single time point ("cross-sectional", brain volume at baseline and six weeks) and two time points ("longitudinal", percentage brain volume change [PBVC]). The estimated PBVC (0.20968) represented a significant increase in brain volume upon remission in this depression patient. Normalized gray matter, white matter, and total brain volumes all increased after six weeks of bupropion treatment (Table 1).

DISCUSSION

The dopaminergic system is correlated with increased gray matter volume in the dorsolateral prefrontal cortex and striatal regions, which are associated with creativity.[1)] The antidepressant bupropion inhibits dopamine and norepinephrine reuptake. Buproprion led to significant improvement in our patient's depression symptoms and significant increases in gray matter, white matter, and total brain volumes. The dopamine and norepinephrine agonist methamphetamine can also increase gray matter volume in the right putamen, which is associated with better in-

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Table 1. The changes in three volumes of the remitted depression patient with bupropion treatment for 6 weeks

Volume (mm^3)	Baseline	6th week
Gray matter volume	863,375.21	869,948.48
White matter volume	812,055.43	819,586.69
Total brain volume	1,675,430.64	1,689,535.17

hibitory control.[2] Apart from these dopamine-related mechanisms, bupropion probably also changes gray matter volume by preventing oxidative stress related to major depressive disorder,[3] or by modulating glutamate receptor function.[4] Gray matter volume might increase for several reasons: synaptic remodeling and neurogenesis;[5] stimulation of neurotrophic factors by antipsychotics;[6] prevention of oxidative stress or 6-OH-dopamine lesioning with subsequent increased glial cell proliferation in the frontal cortex;[7] or modulation of glutamate receptor function.[8]

One concern with these results is the variability of the SIENA method. A longitudinal survey comparing different segmentation methods found that SIENA gives large, heterogeneous values for brain volume changes, implying the variability of this method.[9] Another study mentioned that SIENA could use the outer skull surface for both time points to reduce the effects of scanner drift and inter-scanner variability on longitudinal morphometric results.[10] Therefore, our method still had some value for assessing longitudinal changes with bupropion treatment. This evidence of increased gray matter and total brain volumes with bupropion treatment has clinical implications for the possible effects of norepinephrine and dopamine reuptake inhibition on brain structure in the treatment of depression.

In conclusion, the treatment of depression with bupropion appears to be accompanied by changes in the gray matter, white matter, and total brain volumes.

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