Dose-response assessment of acute and chronic MPD exposure recorded from PFC neurons in freely behaving adult male rats

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The use of methylphenidate (MPD), a commonly prescribed drug to treat attention-deficit hyperactivity disorder (ADHD), has steadily increased over the past 25 years. This trend has been accompanied by more MPD abuse by ordinary individuals for its cognitive enhancing effects. Therefore, understanding the effects of MPD on the prefrontal cortex (PFC), a brain area involved in higher cortical processing such as executive function, language, planning and attention regulation is of particular importance. The goal of this study is to investigate the effects of acute and chronic, dose-dependent MPD exposure on both the PFC neuronal population and behavioral activity in freely behaving animals implanted previously with electrodes within the PFC. For this experiment, four groups of animals were used: Saline (control), 0.6, 2.5 and 10.0 mg/kg MPD. It was observed that the same dose of either 0.6, 2.5 or 10.0 mg/kg repetitive (chronic) MPD exposure elicited behavioral sensitization in some animals and behavioral tolerance in others and that the majority of PFC units recorded from animals expressing behavioral sensitization responded to MPD by increasing their neuronal firing rate, whereas the majority of PFC neurons recorded from animals expressing behavioral tolerance responded to MPD by decreasing their neuronal firing rate. We propose that in animals that display behavioral sensitization, chronic MPD exposure causes an increase in the number of post-synaptic D1 dopamine receptors leading to an increase in behavioral and neuronal firing rate, while in animals that display behavioral tolerance, chronic MPD exposure causes an increase in the number of post-synaptic D2 dopamine receptors leading to a decrease in behavioral and neuronal firing rate.

Biography

Sid Venkataraman is currently a Medical student at the University of Texas McGovern Medical School. He has received his BA from the University of Texas at Austin in 2012 before returning to Houston for Medical School. He is currently conducting research under Dr. Nachum Dafny focusing on the effect of Ritalin on different brain areas. In addition, he is involved in several organizations including the medical student section of the Texas Medical Association and the Executive Board for the McGovern Medical School chapter of neurological surgery students association.

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