Methylphenidate

- Stimulants for disorders of consciousness in the intensive care unit: a randomized, placebo-controlled trial
- Stimulant medications affect arousal and reward, not attention
- Methylphenidate for the cognitive and neurobehavioural sequelae of traumatic brain injury in adults: a systematic review and meta-analysis
- Amphetamine in Adolescence Induces a Sex-Specific Mesolimbic Dopamine Phenotype in the Adult Prefrontal Cortex
- Pharmacotherapy to Improve Cognitive Functioning After Acquired Brain Injury: A Meta-Analysis and Meta-Regression
- A Systematic Review of Pharmacological Interventions for Apathy in Aging Neurocognitive Disorders
- A systematic review of cognitive interventions for adult patients with brain tumours
- Hypersomnia and narcolepsy in 42 adult patients with craniopharyngioma

---

Methylphenidate is a stimulant medication commonly used to treat attention deficit hyperactivity disorder (ADHD) and narcolepsy. It works by increasing the levels of certain chemicals in the brain, such as dopamine and norepinephrine, which can help to improve attention and focus. Methylphenidate is available in several forms, including tablets, capsules, and a long-acting extended-release form. Common brand names include Ritalin, Concerta, and Daytrana. It is generally considered safe and effective when used as directed, but it can have side effects and may not be appropriate for everyone.

An elderly man with advanced glioblastoma developed neuro-cognitive deficits that were reversed by methylphenidate. After tumor resection from the right frontal lobe, he received cranial irradiation, temozolomide, and Tumor Treating Fields (TTFields). MRI afterward showed enhancements near the resection cavity and the contralateral frontal lobe. The patient experienced mild executive dysfunction that was not limiting his activities. Adjuvant temozolomide was started along with TTFields. After 2 cycles, his brain MRI showed stable disease, but he exhibited significant executive dysfunction. Methylphenidate improved his neuro-cognitive slowing in cycles 3 and 4. His disease eventually progressed during the 5th cycle, and he experienced a marked decline in activities. A repeat head MRI revealed tumor progression and cerebral edema. Treatments were discontinued while dexamethasone improved his neurological functions and bevacizumab biosimilar was later added. This case demonstrates the activity of methylphenidate for managing executive dysfunction in patients with glioblastoma while minimizing the use of dexamethasone [1)].

Attention deficit hyperactivity disorder (ADHD) has a prevalence of 7.5% in school-age children in Taiwan. A number of ADHD patients start taking medications in elementary school and continue their treatment until they are in college or adulthood. Methylphenidate is the most frequently used medication prescribed for ADHD treatment. The influence of long-term treatment of methylphenidate on neuro-development, especially dopaminergic neurons, in rats would be explored. This study

investigated the impact of long-term treatment of methylphenidate on different neurons. Rats aged 1 month were divided into three groups: Normal group receiving only sucrose solution, the Low-dose group receiving 2 mg/kg methylphenidate, and the High-dose group receiving 10 mg/kg methylphenidate; for each group, the drug was administreted twice per day. After 7 months of the treatment period, then the alterations in a number of norepinephrine, serotonergic, cholinergic, and dopaminergic neurons were quantified. The number of dopaminergic neurons in the substantia nigra (SN), the serotonergic neurons in the dorsal raphe nucleus, and the cholinergic neurons in the tegmental nucleus significantly decreased as compared with the Normal group, whereas the noradrenergic neurons in the locus coeruleus substantially increased. The whole-cell recording was made from dopaminergic neurons residing in the SN for examination of their firing activity. The recorded dopaminergic neurons in SN were categorized into slow and fast firing using 10 Hz as a classified index. The results displayed that the ratio of dopaminergic neurons with fast firing in the High-dose group was less as compared with those in the Normal and the Low-dose group. Furthermore, the amplitude of action potential of the dopaminergic neurons with slow firing was higher in the high-dose group than those in the Normal and Low-dose groups. The firing behavior of dopaminergic neurons and dopamine concentration in the brain is affected by the long-term challenge of methylphenidate [2].

Subacute administration of methylphenidate after moderately severe head injury appeared to enhance the rate but not the ultimate level of recovery as measured by the DRS and tests of vigilance. Problems with possible selection bias and small sample size limit the generalization of results [3].

1)
McGillion-Moore J, Sampath P, Wong ET. Methylphenidate Reversal of Executive Dysfunction in a Patient with Bi-Frontal Lobe Glioblastoma. R I Med J (2013). 2023 Feb 1;106(1):7-10. PMID: 36706198.
2)
Hsu SP, Wang DY, Min MY, Fu YS. Long-term challenge of methylphenidate changes the neuronal population and membrane property of dopaminergic neuron in rats. Neurochem Int. 2018 Nov 10. pii: S0197-0186(18)30390-5. doi: 10.1016/j.neuint.2018.11.001. [Epub ahead of print] PubMed PMID: 30423424.
3)
Plenger PM, Dixon CE, Castillo RM, Frankowski RF, Yablon SA, Levin HS. Subacute methylphenidate treatment for moderate to moderately severe traumatic brain injury: a preliminary double-blind placebo-controlled study. Arch Phys Med Rehabil. 1996 Jun;77(6):536-40. PubMed PMID: 8831468.