



## The Different Effects Of Endogenous And Exogenous Sex Hormones On Cerebrovascular Diseases

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**Background:** A sexual dimorphism is seen in ischemic stroke. Women have lower stroke incidence than men until an advanced age, when the epidemiology of ischemic stroke shifts and incidence rises dramatically in women. This could indicate the role of sex hormones in pathogenesis of cerebrovascular diseases. This Review summarizes the sex differences related to stroke, and the effects of endogenous and exogenous hormones on the cerebrovasculature of the male and female brain.

**Methods:** We conducted a vast review to analyze possible associations between exposure to endogenous and exogenous female and male steroid hormones and the risks of cerebrovascular diseases. This association is discussed in the context of the effects of sex hormone levels on the progression of atherosclerosis, the vascular tone, and various risk factors including patient's lipid profile, arterial blood pressure and diabetes. Their therapeutic potentials is also reviewed.

**Results:** There is a debate on the role of androgens. A large array of data testifies in favor of a variety of neuroprotective androgen effects in men mostly, but in many cases in women as well. Testosterone supplementation in low to normal levels in hypogonadal men has mostly been shown to benefit the subjects receiving it, but administration in supraphysiological doses however, along with anabolic steroid abuse, seems to adversely affect both the lipid profile and insulin sensitivity in men. Its effects in women have yet to be researched in depth. Due to the lower stroke incidence observed in premenopausal women and robust preclinical evidence of neuroprotective and anti-inflammatory properties of estrogen, researchers have focused on the potential benefits of hormones to reduce ischemic brain injury. However, hormone therapy to postmenopausal females increases the risk and severity of ischemic stroke. Moreover, while estrogen treatment is neuroprotective in younger females, estrogen paradoxically increases infarct volume in acyclic females, which could be due to decreased availability of IGF-1, a neuroprotectant which decreases with advancing age and is down-regulated by estrogen treatment. A wealth of experimental evidence supports the neuroprotective properties of progesterone, and associated metabolites, following various types of central nervous system injury. In particular, for ischemic stroke, studies have also begun to reveal possible mechanisms of such neuroprotection.

**Conclusion:** In conclusion, sex hormones have major roles in sex dimorphism in ischemic stroke. As the debate on the effects of sex hormones continues, understanding the minutie of the implication of them becomes increasingly important. An understanding of the effects of endogenous and exogenous estrogens on cerebral hemodynamics could guide research into explaining how sex hormones have paradoxical outcomes in ischemic events in men and women.

**Key words:** endogenous, exogenous, sex hormones, cerebrovascular diseases



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