

Molecular imaging diagnosis and non-invasive treatment of neurodegenerative diseases

*Meiyun Wang**

No.7, Weiwu Road, Zhengzhou 450003, Henan, China
Department of Medical Imaging, Henan Provincial People's Hospital & School of Clinical
Medicine, Henan University
Zhengzhou, Henan Province, China
mywang@ha.edu.cn

Neurodegenerative diseases are a group of disorders characterized by the progressive degeneration and dysfunction of the nervous system. The most common neurodegenerative diseases include Parkinson's Disease (PD) and Alzheimer's Disease (AD).

Molecular imaging such as Positron Emission Tomography (PET) plays an important role in the diagnosis and evaluation of neurodegenerative diseases. PET imaging with specific tracers is a powerful tool used in neurodegenerative diseases to visualize and quantify various aspects of brain metabolism.

Magnetic Resonance-guided Focused Ultrasound (MRgFUS) is a non-invasive focused ultrasound treatment system guided by magnetic resonance imaging (MRI). It utilizes the thermal effects generated by high-intensity focused ultrasound to achieve tissue ablation for therapeutic purposes. The advantages include high-resolution MRI diagnostic imaging for precise localization, real-time monitoring of temperature via MRI, no need for general anesthesia, and real-time feedback during treatment. In addition, low-intensity MRgFUS combined with microbubbles can temporarily open the blood-brain barrier to achieve drug delivery. It has great potentials to enhance the therapeutic effects for neurodegenerative diseases such as PD and AD.^{1,2} Transcranial Magnetic Stimulation (TMS) is a non-invasive neurostimulation technique that involves applying brief magnetic pulses to specific regions of the brain. TMS can modulate neuronal activity in the targeted brain regions, making it a promising therapeutic approach for various neurological and psychiatric conditions, including neurodegenerative diseases.

The main content of this topic includes: (1) PET with specific tracers in the diagnosis of neurodegenerative diseases; (2) Research progress of non-invasive MRgFUS treatment for PD and AD; (3) Non-invasive TMS treatment for neurodegenerative diseases.

References:

1. Louisa Dahmani, Meiyun Wang*; et al. *NPJ Parkinson's Disease*. **2023**,9(1):90.
- 2 Ali R. Rezai, Marc W. Haut*; et al. *N Engl J Med* **2024**,390:55-62