PIBB 生物化学与生物物理进展
Progress in Biochemistry and Biophysics
2025, 52(4): 803
www.pibb.ac.cn

Immunoregulatory Role of *In vitro*–induced Regulatory T Cells in The Treatment of Ischemic Stroke

DOI: 10.16476/j.pibb.2025.0150 **CSTR**: 32369.14.20250150

Kang *et al*. published a research article on the treatment of ischemic stroke using engineered Treg cells (Kang *et al*., Prog Biochem Biophys, 2025, **52**(4): 946-956. DOI: 10.16476/j. pibb. 2025.0019). Their study mainly explores the immunoregulatory role of regulatory T (Treg) cells in ischemic stroke, providing an innovative therapeutic strategy. Neuroinflammation is a major driver of secondary injury after stroke. Existing treatments focus on vascular recanalization while neglecting immune regulation. Their study proposes to modulate neuroinflammation through *in vitro*-induced Treg cells, offering a novel approach distinct from traditional thrombolysis and endovascular interventions.

Treg cells have been demonstrated strong translational potential by reducing infarct volume, improving behavioral scores, and increasing survival rates, thereby underscoring their neuroprotective effects. Compared to current neuroprotective agents, which have narrow therapeutic windows and limited efficacy, Treg cells may provide broader applicability and complement existing treatments.

The main innovations of their study are as follows.

1 *In vitro*–induced Treg cells for ischemic stroke treatment

It is the first to propose to treat ischemic stroke using *in vitro*-induced Treg cells, thereby filling a critical gap in current therapeutic strategies. It establishes an academic foundation for immune cell therapy in stroke treatment.

Stroke reduces endogenous Treg cell numbers, leading to immune imbalance. their study expands Treg cells *in vitro* and reinfuses them into ischemic brain regions as an intervention.

2 Integration of mechanistic research and therapeutic validation

A major strength of their study is its combination of mechanistic investigation and animal model validation. Using the middle cerebral artery occlusion (MCAO) model, the study systematically assesses Treg cells' effects on neuroinflammation, blood-brain barrier integrity, infarct volume, and neurological recovery. This comprehensive research framework effectively demonstrates Treg cells' therapeutic potential.

3 Innovative immunoregulatory therapeutic approach

their study highlights Treg cells' ability to balance pro-inflammatory (IL-6, TNF- α) and anti-inflammatory (IL-10, TGF- β) cytokines, offering an innovative perspective beyond traditional stroke therapies focused on thrombolysis, neuroprotection, or stem cell transplantation.

In conclusion, their study provides a novel direction for ischemic stroke treatment, validating Treg cells' neuroprotective effects in an MCAO animal model. It effectively integrates mechanistic research with therapeutic evaluation, reinforcing the theoretical foundation for Treg therapy. However, challenges remain, including cell survival, expansion, and long-term safety. Further studies should focus on genetic engineering, optimizing expansion techniques, and identifying the optimal therapeutic window to advance clinical translation.

Overall, their study lays a crucial foundation for immune regulation therapy in stroke and has strong application potential. However, further exploration of its mechanisms and clinical feasibility is essential for its practical implementation.

MA Yin-Zhong
Shenzhen Institute of Advanced Technology, Chinese Academy of Science, Shenzhen 518055, China

Tel: 86-18526653857, E-mail: yz.ma@siat.ac.cn
Received: April 7, 2025 Accepted: April 9, 2025