Subarachnoid hemorrhage treatment research

- Safety assessment of symptomatic intracranial atherosclerotic stenosis: a comparison between sole balloon angioplasty and medical treatment
- Prediction of the 180 day functional outcomes in aneurysmal subarachnoid hemorrhage using an optimized XGBoost model
- Efficacy and safety of tranexamic acid administration for subarachnoid hemorrhage: a systematic review and meta-analysis
- Traumatic oculomotor nerve avulsion with subarachnoid hemorrhage identified using magnetic resonance imaging
- Prognostic value of intracranial vascular tortuosity in thrombectomy for distal vessel occlusion
- Research Progress of External Ventricular Drainage Catheterization Techniques
- Angiographically occult catastrophe: A rare case of aspergillus-induced subarachnoid hemorrhage without mycotic aneurysms following apparent bacterial abscess resolution
- Bilateral Thalamic Edema caused by tentorial galenic dural arteriovenous fistula and Sinus Thrombosis: Successful endovascular therapy

Recent Research and Developments:

Ongoing studies aim to enhance SAH management and patient outcomes:

Clinical Trials: The Mayo Clinic is conducting research to assess patient outcomes and their relationship to various treatments for SAH. MAYO.EDU

Guideline Updates: The American Heart Association/American Stroke Association released updated guidelines in 2023, providing evidence-based recommendations for the management of aneurysmal SAH. AHAJOURNALS.ORG

Innovative Therapies: Research is exploring new treatments, such as intraventricular nimodipine microparticles, which have shown promise in preliminary studies for improving outcomes in SAH patients.

Preclinical experimental studies

He et al. aim to investigate whether Dental Pulp Stem Cells can improve early brain injury after subarachnoid hemorrhage, and explore the mechanisms. In the study, they utilized the endovascular perforation method to establish a subarachnoid hemorrhage mouse model and investigated whether DPSCs administered via tail vein injection could improve early brain injury after subarachnoid hemorrhage. Furthermore, they used hemin-stimulated HT22 cells to simulate neuronal cell injury induced by SAH and employed a co-culture approach to examine the effects of DPSCs on these cells. To gain insights into the potential mechanisms underlying the improvement of SAH-induced EBI by DPSCs, they conducted bioinformatics analysis. Finally, they further validated the findings through experiments. In vivo experiments, they found that DPSCs administration improved neurological dysfunction, reduced brain edema, and prevented neuronal apoptosis in SAH mice. Additionally, they observed a decrease in the expression level of miR-26a-5p in the cortical tissues of SAH mice, which was significantly increased following intravenous injection of DPSCs. Through bioinformatics and

luciferase reporter assay, they confirmed the target relationship between miR-26a-5p and PTEN. Moreover, we demonstrated that DPSCs exerted neuroprotective effects by modulating the miR-26a-5p/PTEN/AKT pathway. The study demonstrates that DPSCs can improve EBI after SAH through the miR-26a-5p/PTEN/AKT pathway, laying a foundation for the application of DPSCs in subarachnoid hemorrhage treatment. These findings provide a theoretical basis for further investigating the therapeutic mechanisms of DPSCs and developing novel subarachnoid hemorrhage treatment research strategies [1)].

Critical Review of He et al.: Investigating the Therapeutic Potential of Dental Pulp Stem Cells in Early Brain Injury After Subarachnoid Hemorrhage

Introduction

The study by He et al. explores whether Dental Pulp Stem Cells (DPSCs) can mitigate early brain injury (EBI) following subarachnoid hemorrhage (SAH) and investigates the underlying mechanisms. The authors utilize a well-established endovascular perforation method to induce SAH in mice and assess the therapeutic efficacy of DPSCs administered via tail vein injection. Additionally, in vitro experiments using hemin-stimulated HT22 cells provide mechanistic insights, particularly in relation to the miR-26a-5p/PTEN/AKT signaling pathway.

Strengths of the Study

Robust Animal Model: The use of the endovascular perforation model is a significant strength, as it closely mimics human SAH pathophysiology, including intracranial pressure dynamics and delayed cerebral ischemia.

Comprehensive Methodological Approach: The combination of in vivo and in vitro models strengthens the validity of the findings. The authors systematically explore neuronal apoptosis, brain edema, and neurological function in SAH mice, correlating these findings with cellular responses in cultured HT22 cells.

Bioinformatics and Molecular Mechanism Analysis: The study provides a mechanistic framework by identifying the miR-26a-5p/PTEN/AKT pathway as a key player in DPSC-mediated neuroprotection. The use of luciferase reporter assays to confirm miR-26a-5p’s interaction with PTEN adds rigor to the molecular analysis.

Potential Clinical Relevance: The findings provide a promising avenue for cell-based therapy in SAH, an area with limited treatment options beyond supportive care and neurosurgical intervention.

Limitations and Areas for Improvement

Lack of Long-Term Outcome Assessment: While the study effectively demonstrates short-term improvements in neurological function, brain edema, and apoptosis, long-term assessments (e.g., beyond the early post-SAH phase) are lacking. Chronic neurological outcomes, cognitive function, and potential long-term integration of DPSCs into neural circuits remain unexplored.

Limited Characterization of DPSCs: The authors do not provide sufficient details on the characterization and differentiation potential of the DPSCs used. Information on their immunophenotype, differentiation capabilities, and potential risk of ectopic differentiation would

strengthen the study.

Potential Immune Response Not Addressed: Although DPSCs are considered immune-privileged, their systemic administration raises concerns about potential immunogenicity, inflammatory responses, or unwanted differentiation, which the authors do not investigate.

Reliance on a Single Cell Line for In Vitro Experiments: The study uses HT22 cells to model neuronal injury, but HT22 cells are immortalized murine hippocampal neurons, which may not fully represent primary cortical or hippocampal neurons. The use of primary neuronal cultures would enhance translational relevance.

Lack of Functional Validation of miR-26a-5p/PTEN/AKT Pathway: While the study establishes a correlation between miR-26a-5p expression and neuroprotection, direct functional validation via miR-26a-5p knockdown or overexpression in vivo would further solidify the mechanistic claims.

Absence of Dose-Response and Optimization Studies: The authors do not explore different DPSC doses, delivery routes, or timing of administration. Optimizing these parameters is crucial for translational applications.

Conclusion and Future Directions

He et al. present a well-designed study demonstrating the therapeutic potential of DPSCs in SAH-induced EBI. Their findings highlight the importance of the miR-26a-5p/PTEN/AKT pathway in mediating neuroprotection, providing a strong foundation for future research. However, several limitations, including the lack of long-term assessments, immune response considerations, and dose-optimization studies, must be addressed before DPSCs can be considered for clinical translation. Future studies should explore the safety and efficacy of DPSCs in larger animal models and examine their impact on long-term neurocognitive recovery.

1)
He P, Zhang H, Wang J, Guo Y, Tian Q, Liu C, Gong P, Ye Q, Peng Y, Li M. Dental Pulp Stem Cells Attenuate Early Brain Injury After Subarachnoid Hemorrhage via miR-26a-5p/PTEN/AKT Pathway. Neurochem Res. 2025 Jan 30;50(2):91. doi: 10.1007/s11064-025-04340-y. PMID: 39883266.