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Super-Selective Intra-arterial Cerebral Infusion Therapy in the Treatment of Brain Cancer: A Review

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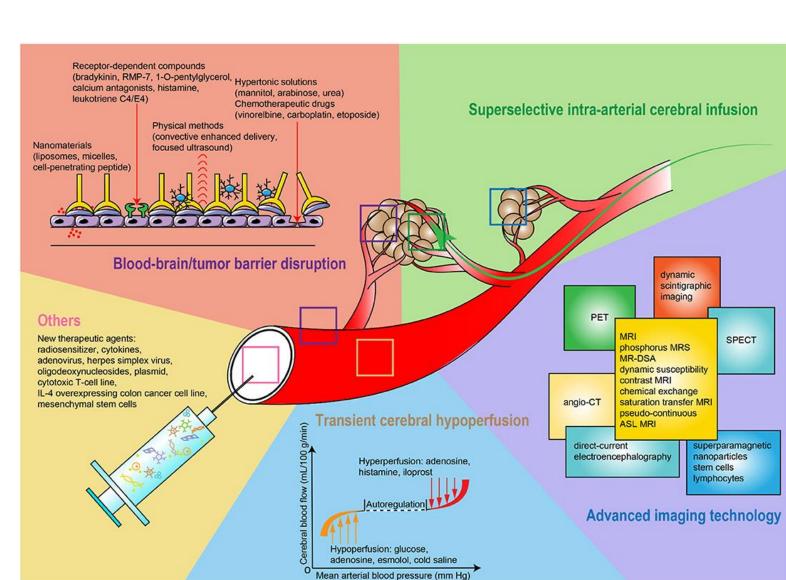
BACKGROUND

Each year over 100,000 Americans are diagnosed with a primary brain cancer, and approximately 20,000 people die each year from brain malignancies [1]. Brain cancers are historically challenging to treat due to limited surgical accessibility, suboptimal drug penetration across the blood brain barrier (BBB), proximity to or involvement of critical life-sustaining structures, and immune privilege. Super-selective intraarterial cerebral infusion therapy (SIACI), a promising intervention that minimizes these barriers, typically combines BBB disruption with targeted chemotherapy to treat intracranial malignancies.

PURPOSE

The purpose of this work is to explore current applications and efficacy of SIACI, as well as highlight future clinical directions.

Figure 1. SIACI Schematic



Huang R, Boltze J and Li S (2020) Strategies for Improved Intra-arterial Treatments Targeting Brain Tumors: a Systematic Review. *Front. Oncol.* 10:1443. doi: 10.3389/fonc.2020.01443

METHODS

A focused literary search was conducted in PubMed and Embase using the search terms "SIACI", "superselective intra arterial cerebral", "selective intra arterial cerebral infusion," "brain cancer", "brain neoplasm", and "brain metastasis". Basic, translational, and clinical studies from 2020-2025 were included in the search parameters. Studies of adult patients with primary or metastatic brain cancer were included.

RESULTS

- Brain cancers are notoriously difficult to treat due to the presence of the BBB, which prevents foreign substances (including medications) from reaching cerebral structures.
- The purpose of SIACI is to combine targeted therapy with BBB disruption to improve treatment response. This approach, if effective, is more ideal than the standard IV chemotherapy and radiation regimens due to its lower side effect profile and improved treatment delivery (Figure 1) [2].
- Early studies with multiple distinct chemotherapy agents have shown promising results in the treatment of intracranial malignancies with SIACI, both in terms of safety and efficacy [3, 4].
- Therapeutic benefit has been shown in primary malignancies as well as metastatic disease [5].

- Although acute stroke has been an anticipated complication of SIACI secondary to blood vessel manipulation, early research indicates this is not a statistically significant risk [6].
- Data also suggests that patients treated with SIACI are less likely to experience systemic toxic effects of chemotherapy, including gastrointestinal upset, which is one of the more debilitating side effects of chemotherapy [7].
- The SIACI method has to date only been used in a few small clinical trials, with future studies focused on optimizing the method of BBB disruption and increasing study populations to better characterize outcomes and adverse effects.

CONCLUSIONS

Current research suggests that SIACI with chemotherapeutic agents coupled with BBB disruption is likely a safe and effective treatment option for intracranial malignancies, with more targeted delivery of medications, fewer systemic side effects, and a relatively low risk for stroke. Larger clinical trials will need to be conducted to determine the role SIACI may play in the treatment paradigm for intracranial malignancies.

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