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# Sonodynamic Therapy and Sonosensitizers for Glioma Treatment: A Systematic Qualitative Review

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## Abstract

Sonodynamic therapy has emerged as an encouraging non-invasive technique that uses ultrasound to activate targeted agents to induce anti-tumor effects for the treatment of glioma. With extensive variation in the types of sonosensitizers, protocols for sonication, and model systems, a comprehensive overview of existing pre-clinical data on the efficacy of SDT in glioma treatment is warranted. Here, we conduct a systematic review of pre-clinical and early clinical literature on implementing sonodynamic therapy (SDT) to treat in-vitro and in-vivo models of glioma. Our findings suggest that coupling sonosensitizers such as 5-Aminolevulinic Acid (5-ALA), hematoporphyrin monomethyl ether (HMME) and sinoporphyrin sodium (DVDMS) with focused ultrasound induces robust cytotoxic activity in tumor cells (in-vitro and in-vivo). These effects are likely mediated by the oxidative stress induced by reactive oxygen species (ROS) production, apoptotic signaling cascades, and intracellular calcium overload. Future research is needed to better understand the biochemical and mechanistic properties of sonodynamic therapy, and ongoing trials may help elucidate the clinical feasibility of glioma treatment with optimized sonically activated treatments.

**Keywords:** 5-ALA; Glioma; SDT; Sonodynamic Therapy.