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Optoacoustics: An emerging, noninvasive theranostic modality for Brain Disorders

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We proposed to use optoacoustics for biomedical applications and for more than 25 years have been working on it starting from idea to clinical studies. At present, optoacoustics is an emerging theranostic modality. This novel technique is based on detection and analysis of optoacoustic waves generated in tissues by short optical pulses. We proposed many important diagnostic, therapeutic, and theranostic applications of this technology; developed and built optoacoustic systems; and performed animal and clinical studies. Our diagnostic applications include noninvasive transcranial mapping, monitoring, and imaging for management of patients with intracranial hematomas, stroke, neurodegenerative disorders, and other neurological conditions. Here we present an overview of our optoacoustic works from ideas and basic science research to studies in tissues in

vitro and to animal and clinical studies. We developed and built medical grade optoacoustic systems for early detection of intracranial hematomas, mapping of cerebral blood oxygenation, and detection of cerebral hypoxia. We tested them in small and large animals (rats and sheep) and then in humans: 1) healthy volunteers; 2) patients with traumatic brain injury (TBI); 3) in neonates (both term and premature); and 4) in fetuses during labor. Recently, we proposed to use optoacoustics for therapy of brain disorders and successfully tested it in rats with TBI. The obtained animal and clinical data indicate that the optoacoustic technique can be used for early diagnostics, therapy, and theranostics of brain disorders. Research support: multiple NIH grants including grants from NINDS, NIBIB, and NICHD.

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