Novel Warning Mechanism for At-Risk Stroke and Epilepsy Patients Through Detection of Harmful Levels of Cortisol

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A rapid, inexpensive, and non-invasive warning mechanism for imminent stroke and epileptic seizures was developed using gold nanoparticle-hydrogel composites. Stroke is the third leading cause of death in US, and Epilepsy affects 50 million people worldwide. Delays in contacting emergencies due to lack of symptom recognition constitute a major reason for these casualties. Thus, early warnings of an attack are critical for patients to access vital, time-sensitive treatments. Although onset of strokes/seizures have been associated with heightened levels of the hormone cortisol, current tests are time-consuming and lab-dependent, due to blood requirements. A faster cortisol level detection would enable quicker response, timely treatment, and increased potential to save lives. My research worked to create hydrogel-nanoparticle crystals that expanded within minutes to markedly different sizes depending on the cortisol concentration in artificial saliva. A monoclonal cortisol antibody was conjugated to GNPs using Classic Passive Adsorption. The nanoparticles were embedded into a hydrogel monomer solution of N-isopropylacrylamide/acrylamide and subsequently gelated. As proof-of-concept, the composites were tested in various solutions of artificial saliva and cortisol for changes in size. Composites exhibited increases in size minutes after exposure to cortisol solutions. Additionally, sizes were significantly greater in solutions with higher, at-risk concentrations of cortisol. The average correlation coefficient between cortisol concentration in artificial saliva and size of composites was found to be 0.90, indicating a strong linear association. These results show that the composites can work as an efficient risk indicator for stroke, seizures, and cortisol-related diseases.

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Fourth Award of $500