Non-Invasive Detection of Asymptomatic Heart Attacks Using BioElectrics Through Transcutaneous Blood Analysis

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Silent Myocardial Infarctions (SMIs) produce non-specific ambiguous symptoms in patients who are at-risk (ie., diabetic, etc.) because of associated nerve damages. Currently, there's almost no scope for their early detection and prevention because doctors are unlikely to warrant expensive and invasive diagnostic biomarker blood tests unless patients report symptoms like chest pain. In this study, h-FABP (heart type Fatty Acid Binding Protein) was chosen as an optimal biomarker for the early and non-invasive detection of SMIs. h-FABP being negatively charged and small in size presents a novel method for being isolated from other charged molecules in the bloodstream when a small positively charged electric potential is applied on the dermal capillaries (i.e., skin). To test this, a model was constructed in which h-FABP (14.9 kDa) was isolated from a bigger protein Albumin (66.5 kDa). Results showed that ~173 mV of positively charged electricity could isolate h-FABP in the bloodstream. Conventional Raman systems are limited in applications pertaining to non-invasive blood analysis & self-diagnosis due to their decreased stability, cumbersome nature and high-cost. A non-invasive spectrometer that employed transcutaneous blood analysis through a novel PLS based statistical model was constructed to determine h-FABP's concentration post its isolation in the bloodstream, to achieve self-diagnosis and to create risk alerts when blood h-FABP levels are abnormal. The calculated result of h-FABP levels in one of the diabetic human participants showed a coefficient of determination of 96.2% and a mean absolute error of 0.115 ng/mL. The feasibility and accuracy of the in-vivo study were verified using parallel in-vitro tests.

Awards Won:
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