Using Modified S100A9 Monoclonal-Antibody-Infused Field Effect Transistors to Accurately Detect the Presence of Early Stage Renal Cell Carcinoma

Laurie, Mark

Renal Cell Carcinoma is a deadly form of cancer that is asymptomatic almost always until it is metastatic and terminal for the patient, explaining why the 5 year survival rate is less than 8%. Additionally, the cost for an ELISA for Aquaporin-1, a biomarker of RCC, is approximately $675, which is too expensive for widespread use by the public. However, various studies have shown that a specific protein, S100A9 is upregulated in the urine of people with RCC. In addition, the new-found knowledge of using carbon nanotubes as a field effect transistor regarding the detection of specific antigen concentration could be exploited to accurately detect this specific protein. Therefore, various dilutions of S100A9 and its antibody were made, and filter paper was dip-coated in ultrasonically dispersed single walled carbon nanotubes. 8 antibody dilutions were tested against 15 different antigen concentrations, and the average resistance was recorded for each; after a statistical analysis, dose response curves revealed a nonlinear correlation with critical values, some as high as 0.981, suggesting statistical significance. In addition, the specificity was found to be higher while using the lower S100A9 antibody concentrations in that there was a more discernible difference between the tested S100A9 concentrations and the measured resistance Due to these promising data, future tests that exercise clinical urine trials will be conducted to further the development of this diagnostic, and a dual field-effect-transistor assay may be implemented in the diagnostic's design for augmenting the specificity. With a total cost of approximately $10 per test, future international implementation of this diagnostic can prevent the spread of Renal Cell Carcinoma, thereby saving thousands of lives.

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