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Potential urinary miRNA-141 as a biomarker for detection of prostate cancer by using screen printed carbon electrode based electrochemical microRNA sensor

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Introduction & Objectives: As known that exosomal miR-141 in the serum is significantly upregulated in the patients with prostate cancer (PCa), and is considered as a useful potential biomarker for the diagnosis of PCa. However, compare to the serum miRNA, the urinary miRNA is much easier to be obtained from patients, and maybe serve as a non-invasive biomarker for diagnosis of PCa. To our knowledge, the urinary miR-141 did not applied on the biosensor to detect PCa patients so far. Herein, we aim to development a screen-printed carbon electrode (SPCE) based electrochemical microRNA biosensor (mirsensor), and further validation of diagnostically useful, non-invasive, urine-based miR-141, hopefully that might help with diagnose PCa.

Materials & Methods: The current electrochemical biosensor platform was modified with the streptavidin/biotin system on screen-printed carbon electrodes (SPCEs) to detect the specific miR-141 in urine to predict prostate cancer. We designed a two-step sensing platform; in brief, a half sequence of target urine miR-141 would be firstly grasped by designed probe that modified with FITC fluorescein dye; subsequently, the rest part of miR-141 sequence continue binding with biotinylated probe that has already covalent-linked onto the SPCE carboxylic sensor surface. Once the FITC probe/ miR-141/ biotinylated probe duplex formation that would immediately against with anti-fluorescein horseradish peroxidase enzyme (HRP), and further catalyze the hydrogen peroxide to give a signal for detection. In this study, total five urine samples were collected from clinical PCa patients, an average data from ten individual normal volunteers' urine were used as a control. The quantitative RT-PCR results were used to confirm the sensitivities of mirsensor.

Results: All the cases results were derived from triplet tests to make sure the mirsensor stability. Obviously, our preliminary data showed a significant readout signals for miR-141 by the much higher absolute value of current in all the PCa cases no matter the status of patients' stages, when compare to the normal urine samples. In addition, the consistent results to the quantitive RT PCR were demonstrated the reliabiities and stabilities of our mirsensor.

Conclusions: In conclusion, this mirsensor is a promising technology for the rapid and convenient detection of PCa in real urine samples. Besides, urine exosomes may serve as a more suitable and non-invasion material compared with the samples derived from the other sources, for examples whole serum from the circulating blood or tumor cells from the tissues etc. Furthermore, exosomal miR-141 is significantly upregulated in the urine from patients with PCa compared with the healthy volunteers no matter the status of stages; indeed, it should be considered as a useful potential biomarker to help for the diagnosis of PCa.