A Label-Free Size-based Micro Coulter Counter System for Circulating Rare Tumor Cells

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INTRODUCTION

◆ Circulating Tumor Cells
  - Cells that have detached from a primary tumor and circulate in the bloodstream
  - Powerful tool for medical application
    - cancer prognosis, diagnosis of minimal residual disease
    - assessment of tumor sensitivity to anticancer drugs
    - personalization of anticancer therapy
  - Characteristics
    - rare cells (about 1 – 100 cells per mL of whole blood)
    - epithelial type (EpCAM)
    - bigger size than peripheral blood cells

◆ Conventional CTC detection method
  - PCR-based approaches
    - merit: very sensitive
    - demerit: low specificity (can result in false positives)
  - Immunochemistry-based techniques
    - merit: multi-parameter (EpCAM, CD45, CK, etc)
    - demerit: misses some CTCs (lack of exact antibody), low purity
  - Size-based techniques using pores
    - merit: independent with parameters (like antibodies)
    - demerit: physical damages by high pressure

◆ Coulter counter-based CTC counting Method
  - Size-based cytometry approaches
    - merit: independent with parameters, no physical stresses, potential to sort CTCs without need a sample preparation

METHODOLOGY

◆ Schematic Diagrams of Developed System

RESULTS

◆ OVCAR-3 cells spiking Test

(a) Detection of CTCs in breast cancer patient samples with resistance change and fluorescence.
(b) The number of CTCs was lower than 5 spiked CTCs (at 10, 100, 500, and 1000 cells).

DISCUSSION

- Although test time for larger volume of blood is long, the simplicity of the microchannel and system enables the system to parallelize easily.
- The proposed system has a sufficient potential to detect CTCs in the blood.
- Flow cytometry-based detection system is expected to separate CTCs from blood.

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