Precision Microfilters for Capture and Culture of Circulating Tumor Cells

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ABSTRACT

A promising method to achieve personalized cancer therapy is to isolate viable circulating tumor cells (CTCs) from the patient and culture them to test their response to drugs. Methods to culture CTCs is receiving extensive interest for research purposes. CTCs can be isolated by size-exclusion using microfilters. Here we present microfilters with precision pores with uniform distribution. Combining cell isolation with culture in one device eliminates cell loss, minimizes cell damage, and facilitates cell growth with simple and rapid workflow.

INTRODUCTION

Nonfluorescent, highly detailed fluorescent images are obtained using 20x magnification. High porosity (160,000 pores) enables easy microscope imaging with parsimonious use of reagents and resources. Filtering cells allows for time savings, and maintains cell viability. 7.5 mL spiked samples were incubated at 37°C for 2 h. Cells were subsequently fixed, permeabilized, and stained for nuclei (Hoechst 33342; gray), cytokeratins (green), EpCAM (red), and CD45 (blue). The captured MCF-7 cells could subsequently be cultured on the filter membrane by using both in-holder and standard culture methods. The cultured cells could be characterized by immunofluorescence antibody staining.

RESULTS

Functional analysis of CTCs requires isolation of viable tumor cells from peripheral patient blood. We demonstrated that microfiltration can enrich viable MCF-7 cells from whole blood.

- Capture efficiency for unfixed MCF-7 cells spiked into blood was 74%.
- The workflow is easy and rapid.
- The captured MCF-7 cells could subsequently be cultured on the filter membrane by using both in-holder and standard culture methods.
- Contaminating normal blood cells did not affect the cell culture.
- The cultured cells could be characterized by immunofluorescence antibody staining.

Isolation and culture of CTCs using the CellSieve™ microfiltration system provide a novel tool for studying biological function of viable CTCs and for assessing drug sensitivity.

CONCLUSIONS

- Functional analysis of CTCs requires isolation of viable tumor cells from peripheral patient blood. We demonstrated that microfiltration can enrich viable MCF-7 cells from whole blood.
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