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Nanocytology as a novel biomarker for personalized cancer management

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Abstract

Cancer is deadly because cancer cells invade and metastasize. Studies from us and others have showed that cell nanomechanical properties, e.g., cell elasticity, softness, and deformability, may be a new class of quantitative markers of tumor cell behavior. The aggressive tumor cells may be softer, more deformable, and less stiff and thereby have more flexibility and mobility than benign cells. The cell nanomechanic property is regulated by signal pathways of cytoskeletal remodeling. Using Atomic Force Microscopy and other state of art deformity cytometer, we measured the metastatic tumor cells obtained from remnants of patient's body cavity fluid samples, and found a marked difference in softness and deformability between malignant cells and benign mesothelial cells present in the same sample, and common modulus of cell softness in different cancer types metastatic to body cavity (*Nature Nanotechnology, 2007, PNAS, 2011*). We further demonstrated that chemopreventive and therapeutic agents including green tea extract and other commonly used chemotherapeutic drugs have profound effect on cancer cell mechanics, and the measurements may be a marker for platin-based drug sensitivity. Works on primary tumors collected by fine needle aspiration and other cytological samples for example urine is now undertaking (*Nanomedicine, 2012*). Together, nanomechanical analysis can be performed on clinical cytological specimens, and Youngs modular E may be a quantitative functional biomarker that can be used for personalized cancer management. Combining cytomorphological analysis with molecular expression profiling as well as functional cancer cell mechanical measurements may bring the morphologically based cytology into the age of FUNCTIONAL nanocytology.

Biography

Jianyu Rao, M.D., is a tenured Professor in Pathology and Epidemiology at David Geffen School of Medicine, University of California at Los Angeles. He is the chief of cytopathology section and chief of gynecological pathology section at Department of Pathology and Laboratory Medicine of UCLA David Geffen School of Medicine. He is American Pathology Board-certified pathologist with sub-specialty board in cytopathology, a member of College of American Pathologist, a member of UCLA's ACCESS graduate program, and a member of Jonsson Comprehensive Cancer Center. His clinical expertise is genitourinary tract pathology, gynecological pathology, and cytopathology. His main research interest is to study cytoskeletal actin remodeling in tumorigenesis and to develop biomarkers and new technologies, including nanotechnologies that can be used for cancer cell screening and diagnosis in either individualized therapeutic and population-based chemopreventive settings. He has 28 years of research experience in these areas, with over 100 publications and research funding from NIH, DOD, State, and private sources. Recently he is interested in adding nanomechanical analysis as a new dimension for functional cytological analysis of cancer cells.