Biochips for Hepatocellular Carcinoma

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With the anticipated growth in cancer cases as population's age, the early detection has become critical and represents a key driving force to improve and expand health services. Mass screening for early detection of cancer by efficient and cost effective devices will reduce the ever increasing social costs associated to handling patients with diseases which are at advanced stage for failure of existing diagnostic procedures or non adequateness for broad use. Many biomarkers have been found overexpressed in neoplastic tissues and some are used for diagnostic application. However, mainly due to the cancer heterogeneity, no single marker has shown to be fully satisfactory in terms of sensibility and specificity for early cancer detection. This still unmet medical need could be fulfilled by combining non overlapping biomarkers and developing nanosized technological platforms (biochips) for their simultaneous detection, with adequate sensitivity and specificity for clinical use at significantly lower costs per assay than traditional methods. Biochips will make the identification of many cancers possible within minutes and directly at the point-of-care, thus doing away with the conventional techniques, where samples are sent to a laboratory and put through labour-intensive processes that may take several hours to achieve a result. Many factors should be considered when designing biochips for cancer detection. First the selection of biomarkers to be monitored. Many conventional biomarkers are questioned in regard to utility in a clinical setting and should be replaced by novel, more effective biomarkers. Second, since cancer is heterogeneous, the biochip should be able to monitor non overlapping biomarkers in order to increase sensitivity while maintaining specificity at high values. Third, the biochip should be inexpensive to allow massive use. Biomarker-IgM immune complexes, a novel class of cancer biomarkers [1-5], are endowed with adequate characteristics for biochip development, since they show high diagnostic accuracy in detecting cancer at the early stage, they may be combined to increase sensitivity without affecting specificity [3] and they display a self-built capability to amplify detection which makes biochip fabrication easier, cheaper and faster. By thermal ink-jet printing an opto-electronic biochip for hepatocellular carcinoma has been fabricated for the simultaneous quantitative detection of SCCA-IgM [1] and AFP-IgM [2] by using internal calibrators. Compared to conventional AFP determination, biochip output provided higher diagnostic accuracy on the same panel of patients, with minimal amount of sample, in few minutes and requiring low cost instrumentations.

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3. Gallotta et al, Dig Liver Dis 2009 41/5:A15,
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