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Developing cell line with optical reporter and target-specific molecular imaging agents for liver cancer research

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Liver cancer is the fifth most common cause of cancer deaths worldwide. Both early detection and effective treatment are difficult because the lack of knowlege of liver cancer biology. Recent progress of tumor cell lines with optical reporters provides an excellent tool to study cancer genetics, tumor development and progression. The non-invasive target-specific molecular imaging allows us to study cancer cell changes over time and the disease heterogeneity. The improvements of acknowledgement and the technology have provided hope for accurate and early non-invasive detection as well as treatment of liver cancer. The aims of this study were 1) To develop liver cancer cell line with optical reporter and study tumor progression; 2) To test the feasibility of injecting a cocktail of specific molecular imaging agents to noninvasively image liver cancer. The liver cancer cell with red fluorescent protein (RFP) reveals the tumor progression over time. The target-specific cocktail contained agents for imaging the neovasculature (RGD peptide), matrix metalloproteinase (MMP), and glucose transport (^{18}F fluorodeoxyglucose [^{18}F-FDG]). RGD, MMP, and ^{18}F-FDG were imaged on tumor-bearing mice using PET, CT, X-ray, and multi-wavelength optical imaging modalities. Image data demonstrated that each agent is bound to a specific disease target component. The same liver cancer xenograft contained multiple disease markers. Those disease markers were heterogenetically distributed in the same tumor nodule. The molecular imaging agents had different distributions in the whole body and inside the tumor nodule. All target-specific agents yielded high tumor-to-background ratios after injection. In conclusion, tumor cell line with optical report provides a useful tool to study cancer biology. Target-specific molecular imaging agents can be used to study liver cancer *in vivo*. Non-invasive multimodal/multi-target-specific molecular imaging agents could provide detail information to simultaneously study multiple liver cancer components.

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