Research Abstract

Development of A Novel Fluorescent NIR Probe for Cancer Bioimaging

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Background: Optimal cancer bioimaging is imperative and come in various forms, ranging from screening to detection and surgical guidance. Current imaging tools being used are not cancer-specific and tend to expose patients to radiation. Therefore, there is a crucial need to develop newer and safer imaging modalities. Near InfraRed fluorescence (NIRF) agents have been gaining great attraction for cancer imaging in the past years, because of their high resolution/sensitivity, low cost, and real-time visualization/imaging capabilities without ionizing radiation. Hence, NIRF-based cancer imaging counterpoises some of the obstacles elicited by traditional imaging. Indocyanine green (ICG) is the only FDA approved NIR fluorescent probe for cancer imaging and image guided surgery in clinical settings. However, ICG has several limitations associated with its photostability, high concentration toxicity, and short circulation time. Additionally, internalization of ICG is not cancer-specific. To overcome this, we engineered a novel poly (vinyl pyrrolidone) (PVP) and tannic acid (TA) based nanosystem (PVT) to carry ICG to cancer cells/tissues.

Methods: Pursuing the novel nanoimaging approach, our lab has developed PVP-TA-based ICG (PVT-ICG) fluorescent nanoparticles. An IVIS imaging system was used to measure NIR fluorescence of PVT-ICG and its physiochemical properties were further characterized. Moreover, human breast, pancreatic, liver, and prostate cancer cell lines, and cancer tissue microarrays (TMAs) were histochemically stained to assess cancer cell targeting/specificity of PVT-ICG.

Results: PVT-ICG indicated particle size and surface charge ideal for cancer cell/tissue delivery. Furthermore, PVT-ICG demonstrated improved fluorescent intensity. Cellular and tissue-binding studies exhibited a superior cancer targeting/specificity achieved from PVT-ICG nanoparticles compared to free ICG dye in all cancer cells/TMAs

Conclusion: Collectively, our findings suggest that this NIRF probe PVT-ICG has great potential for becoming a novel and safe imaging modality for various types of cancer cells and tumors which can result in early cancer diagnosis leading to improved disease management.