

Description for the general public(in English)

After lung cancer, prostate cancer (PC) is the most common and the second leading cause of cancer death. Currently, the gold standard for PC diagnosis is prostate-specific antigen (PSA) testing and digital rectal examination. However, these tests often result in overdiagnosis and overtreatment as only a small percentage of these cancers metastasize and ~3% result in death. This results in additional medical visits, prostate biopsies, unnecessary radiation and even prostatectomy. Furthermore, some of the treated patients may experience relapse, which triggers additional tests that are often inconclusive. Transrectal ultrasonography, Computed Tomography, Positron Emission Tomography and Magnetic Resonance Imaging (MRI) are also used for PC diagnosis and staging, yet they are of limited value mostly because of the low sensitivity and specificity in the detection of tumor tissues and lymph node metastases.

A method that would improve PC staging is needed to allow better detection of potentially cancerous cells. This method would identify those men with life-threatening PC for whom curative intervention would improve outcomes. It would also eliminate unnecessary treatment and unwanted biopsies. To address this gap we propose to take advantage of recent developments in nanotechnology and the distinctive properties of prostate tumor cells to show that molecular MRI using targeted contrast agents can localize small (a few mm size) prostate cancers.

MRI is potentially a very good diagnostic tool however, it often fails to distinguish malignant from benign tumors. To increase MRI sensitivity contrast agents comprising gadolinium have been used. Their accumulation in tissue is solely based on differences in vasculature between tumor and normal tissues; detection of specific tumor types is not achieved. We propose to develop a targeted contrast agent that can localize small prostate cancers. New core/shell (NaDyF₄/NaGdF₄) magnetic nanoparticles (NP), that shorten both T₁ and T₂ relaxation times, thus providing optimum tumor contrast will be developed and bioconjugated with Prostate Specific Membrane Antigen (PSMA) specific antibody. As shown in previous studies, PSMA is significantly upregulated in prostate cancer cells making it an excellent target.