Prostatic cancer and optical nanoprobes for theragnostic

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Prostatic carcinoma (PCa) is the most common cancer in men. In clinical practice, the initial biopsy scheme is based on blind sampling of 10-14 cores; this procedure shows an overall cancer detection rate of 27 %–40.3 %. Therefore, providing more specific imaging tools to improve the detection rate of significant tumors with biopsies could further improve the management of PCa. Multiparametric magnetic resonance (MR) imaging followed by targeted biopsies has already shown to improve such a management with a decreased detection rate of low-risk PCa and an increased detection rate of intermediate/high-risk PCa. However, multiparametric MR imaging is lacking specific. Therefore the development of new specific molecular imaging strategies is required in order to accurately identify significant prostatic tumors and to target biopsies.
The first step included the development of a new bimodal imaging device and new probes for imaging prostate cancer. This is why, combination of transrectal US biopsy and optical molecular agent targeting index lesions was proposed. Prototype setup has been developed (ANR Tecsan Prostafluo 2008-2010) and the technique has been successfully demonstrated *in vivo* on canine prostate.
Lipid nanoparticles, Lipidots® can be used as nanoprobes with encapsulated fluorophore targeting the lesions specifically or by EPR effect, and/or as nanocarriers for focal therapy.
The use of the scFv format of the mAb D2B, targeting the extracellular domain of PSMA, as a fluorescent probe to detect deep prostatic cancer cells was validated. The probe was evaluated using an orthotopic tumor mouse model and *in vivo* fluorescence tomography as imaging method.
Local therapies of index lesions show a growing interest to avoid overtreatment. Once prostate cancer is precisely and specifically localized, biopsy could be coupled with local injection of either nanocargo or the same nanovehicles used for imaging, containing drugs.
Main problems of translation to patients include: First, agreement by agencies of these nanoprobes, mainly if targeted; second, the problem of off-target effects in case of systemic infusion.

References

- Boutet, J. et al. (2009) Bimodal ultrasound and fluorescence approach for prostate cancer diagnosis. J. Biomed. Opt. 14, 064001
- Mazzocco C. et al. In vivo imaging of prostate cancer using an anti-PSMA fragment as a probe (Submitted).