The increasing incidence of prostate cancer, which is the most frequently diagnosed malignancy in the western male population [1], poses an increasing burden on healthcare. PSA screening and TRUS-guided biopsy are revealing more and more patients with this disease. As long as prostate cancer is confined to the prostate (that is no extracapsular extension, no seminal vesicle invasion or no metastatic spread to lymph nodes or bones) treatment of the disease has a curative intent. Clinically localized prostate cancer is typically managed by well-established whole gland therapies like radical prostatectomy or radiotherapy (brachytherapy or external beam radiotherapy).

Approximately 30% of patients who underwent radical prostatectomy will develop biochemical recurrent disease [2,3]. Biochemical failure, i.e. a rising serum PSA in the absence of demonstrable metastases, is widely accepted as an appropriate endpoint for defining treatment failure in men with localized prostate cancer. The serum PSA is routinely used to monitor disease recurrence after definitive therapy because biochemical recurrence antedates metastatic disease progression and prostate cancer–specific mortality by an average of 7 and 15 years, respectively [4-6]. Patients with biochemical recurrence after radical prostatectomy have an 88% 10-year overall survival rate compared to a 93% in males without signs of biochemical recurrence [7].

Approximately 25-30% of patients with newly diagnosed prostate cancer undergo EBRT as their definitive treatment [8-10]. Unfortunately, up to 50% of patients develop biochemical failure, presumably due to local recurrence after 5 years [11-15]. Currently, serum PSA increase after radiotherapy is the best indicator of biologically active tumor [16,17]. Whenever such an elevation of serum PSA after nadir has taken place, imaging is required to investigate whether this increase is due to local or systemic recurrent disease. Local recurrence (30%) may be amenable to

salvage therapy, while systemic recurrence may be an indication for systemic treatment [18-21].

Although T2-weighted MR imaging plays an important role in localizing prostate cancer in the untreated gland, evaluation of local recurrence in the radiated prostate gland by T2-weighted MR imaging is limited by treatment-induced relaxation time changes. Several reports suggest MR spectroscopic imaging, which detects abnormal metabolism, is accurate in this setting. Other functional MR techniques, such as diffusion-weighted imaging and dynamic contrast-enhanced MR imaging yield similar promising results. The ability to detect or exclude local recurrence within the prostate by multiparametric MR imaging can thus facilitate salvage treatment, or systemic therapy in patients with presumed local recurrence based on biochemical failure.

References:

1. Siegel R, Naishadham D, Jemal A. Cancer statistics, 2012. CA Cancer J Clin 2012;62:10-29
2. Djavan, B, Moul JW, Zlotta A, Remzi M, and Ravery V. PSA progression following radical prostatectomy and radiation therapy: new standards in the new millennium. Eur Urol 2003;43:12-27
3. Khan MA, Han M, Partin AW, Epstein JI, Walsh PC. Long-term cancer control of radical prostatectomy in men younger than 50 years of age: update 2003. Urology 2003;62:86–91;discussion 91-2

4. Stephenson AJ, Kattan MW, Eastham JA, et al. Defining biochemical recurrence of prostate cancer after radical prostatectomy: a proposal for a standardized definition. J Clin Oncol 2006;24:3973-8
5. Pound CR, Partin AW, Eisenberger MA, et al. Natural history of progression after PSA elevation following radical prostatectomy. JAMA 1999;281:1591-7
6. Freedland SJ, Humphreys EB, Mangold LA, et al. Risk of prostate cancer-specific mortality following biochemical recurrence after radical prostatectomy. JAMA 2005;294:433-9
7. Jhaveri FM, Zippe CD, Klein EA, Kupelian, PA. Biochemical failure does not predict overall survival after radical prostatectomy for localized prostate cancer: 10-year results. Urology 1999;54:884-90
8. Stanford JL, Stephenson RA, Coyle LM, et al. Prostate Cancer Trends 1973-1995, SEER Program, National Cancer Institute. In:NIH Pub. Bethesda, MD, 1999.
9. Vulto JC, Lybeert ML, Louwman MW, Poortmans PM, Coebergh JW. Population-based study of trends and variations in radiotherapy as part of primary treatment of cancer in the southern Netherlands between 1988 and 2006, with an emphasis on breast and rectal cancer. Int J Radiat Oncol Biol Phys 2009;74:464-71
10. Cooperberg MR, Grossfeld GD, Lubeck DP, Carroll PR. National practice patterns and time trends in androgen ablation for localized prostate cancer. J Natl Cancer Inst 2003;95:981–9
11. Zietman AL, DeSilvio ML, Slater JD, et al. Comparison of conventional-dose vs high-dose conformal radiation therapy in clinically localized

adenocarcinoma of the prostate: a randomized controlled trial. JAMA 2005;294:1233-9

12. Shipley WU, Thames HD, Sandler HM, et al. Radiation therapy for clinically localized prostate cancer: a multi-institutional pooled analysis. JAMA 1999;281:1598-604
13. Jabbari S, Weinberg VK, Shinohara K, et al. Equivalent biochemical control and improved prostate-specific antigen nadir after permanent prostate seed implant brachytherapy versus high-dose three-dimensional conformal radiotherapy and high-dose conformal proton beam radiotherapy boost. Int J Radiat Oncol Biol Phys 2010;76:36–42
14. Abramowitz MC, Li T, Buyyounouski MK, et al. The Phoenix definition of biochemical failure predicts for overall survival in patients with prostate cancer. Cancer 2008;112:55–60
15. Horwitz EM, Bae K, Hanks GE, et al. Ten-year follow-up of radiation therapy oncology group protocol 92-02: a phase III trial of the duration of elective androgen deprivation in locally advanced prostate cancer. J Clin Oncol 2008;26:2497–2504
16. Horwitz EM, Vicini FA, Ziaja EL, Dmuchowski CF, Stromberg JS, Martinez AA. The correlation between the ASTRO Consensus Panel definition of biochemical failure and clinical outcome for patients with prostate cancer treated with external beam irradiation. American Society of Therapeutic Radiology and Oncology. Int J Radiat Oncol Biol Phys, 1998;41: 267-72
17. Pound CR, Brawer MK, Partin AW. Evaluation and treatment of men with biochemical prostate-specific antigen recurrence following definitive therapy for clinically localized prostate cancer. Rev Urol 2001;3: 72-84

18. Moul JW. Prostate specific antigen only progression of prostate cancer. J Urol 2000;163:1632-42
19. Stephenson AJ, Scardino PT, Bianco FJ, Jr., Eastham JA. Salvage therapy for locally recurrent prostate cancer after external beam radiotherapy. Curr Treat Options Oncol 2004;5:357-65
20. Catton C, Milosevic M, Warde P, et al. Recurrent prostate cancer following external beam radiotherapy: follow-up strategies and management. Urol Clin North Am 2003; 30:751-63.
21. Letran JL, Brawer MK. Management of radiation failure for localized prostate cancer. Prostate Cancer Prostatic Dis 1998;1:119-27