

## Radiation Therapy, Guided Therapy and Related Topics

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Although a large number of men above age 50 will develop prostate cancer, only in a small proportion of patients will their tumor become aggressive. For the majority of men with non-aggressive tumors, one can delay invasive treatment until the tumor becomes aggressive (watchful waiting). It is essential to precisely characterize the tumor. This can be achieved with multi-modality MRI. With nomograms based on the serum PSA-value, the tumor's aggression (expressed in Gleason-grade), and the outcome of a digital rectal examination, an attempt is made to predict the aggression and local extension of the tumor, and detect the presence of lymph node metastasis. Based on these nomograms, the further treatment strategy is determined. Unfortunately, these nomograms are only moderately reliable, so that it is not always possible to make the right treatment decision. By means of functional (multi-modality) MR imaging, information can be acquired regarding the aggression of the tumor. Furthermore, an MR-examination, performed at high field strength (3 Tesla) with use of an endorectal coil (ERC), allows a very accurate determination of minimal (sub-millimeter) extra-prostatic spread. The sensitivity and specificity of 3T ERC MR imaging for determination of extra prostatic disease are respectively 87% and 96%. If it is decided to surgically remove the prostate, it is important to know where the tumor is located and whether it shows extra-prostatic growth. If the tumor is distant from the neurovascular bundle, these bundles can be spared. This decreases the chance of postoperative impotence. If the MRI shows obvious extra-prostatic extension, it can be concluded that surgery is less useful so the best choice is hormonal therapy with or without radiotherapy. Nowadays, prostate cancer is increasingly treated with directed, local radiotherapy. If the precise location of the tumor is known, it is possible to give a local boost to this location in the prostate. This has the advantage that less radiation is given to the surrounding tissue, with fewer side effects. An MRI can supply this information<sup>1</sup>. As MRI more accurately visualized the tumor in the prostate compared to Trans Rectal Ultra Sound (TRUS), these techniques potentially also can be used for improved local non-invasive therapy. An additional advantage of MR is the fact, that with this technique temperature changes can be monitored in real-time.

### Lymph Node Metastasis

Hormonal therapy with or without radiation is the best treatment if there are metastases to the lymph nodes. The risk of lymph node metastasis is currently determined with the help of the previously described (inaccurate) nomogram. In patients with an elevated risk for metastasis, additional examinations are required. Currently, the most used imaging techniques for detecting lymph node metastasis are multi-detector CT (MDCT) and conventional MRI. The accuracy of MDCT and conventional MRI is not high. This makes supplementary invasive diagnostic examination in the form of surgical pelvic lymph node (PLN) dissection mandatory. There is a new MRI technique using a lymph-node-specific contrast agent (Combidx) (MRL)<sup>2,3</sup>. Using iron-oxide containing nano-particles. The sensitivity, specificity, negative and positive predictive values in specialized centers are 90%, 94%, 98% and 75%, respectively. The diagnostic accuracy of MRL in the detection of lymph node metastasis is significantly higher than with MDCT<sup>4</sup>. The high negative predictive value (>96%) of MRL means that after a negative result on MRL, PLN dissection does not have to be performed. Due to the latter, obtaining a diagnosis with MRL is economically cheaper and results in fewer complications than with the current invasive diagnostic technique of MDCT + PLND. In addition, in at least in 30% of patients, thanks to MRL, nodes are detected which are not found by the routine PLN dissection, as they are located in the internal and common iliac, peri-rectal and para-aortic regions. The positive and negative nodes can be made visible on a combined CT-angiography-MRL image. In this way, the location of positive nodes relative to the large pelvic vessels can be visualized. This information can help the surgeon to find these nodes or help the radiation oncologist to give selective lymph node radiotherapy. Unfortunately, the iron oxide contrast agent has not yet obtained official registration.

### PSA Recurrence

If there is a PSA rise in a treated patient, the most important question is: is this the result of a local recurrence, or is it caused by lymph nodes or bone marrow metastases? MRI also has a role in this situation. First, bone metastasis can be excluded by means of a 'whole-body' MRI. If this is negative, then Combidx MRL should be used to exclude node metastasis. In post-treated patients, we found no correlation between PSA value or PSA doubling time and positive nodes. There was, however, a positive correlation between PSA velocity and positive nodes on MRL. Thus, even in patients with a low PSA, but high PSA velocity, a MRL is of use to exclude metastases. Finally, multi-modality MRI can be performed to determine if there is a local recurrence.

### References

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