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MR imaging in primary irradiated prostatic carcinoma

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The main objective of our investigation was to determine the role of endorectal surface coil magnetic resonance (Endo-MR) in the monitoring of patients with prostate cancer before and after external beam radiation (EBR). A prospective study was performed on 26 patients with biopsy proven prostate cancer. All patients underwent Endo-MR prior to external beam radiation (pre-EBR). Six months after EBR (70Gy/1.8-2 Gy), another Endo-MR examination was performed until now in 14 patients (post-EBR). We used a 1.5 Tesla unit performing T1 and T2 weighted spin echo or fast spin echo sequences in axial and coronal planes. Imaging analysis included the assessment of tumor size, prostate capsule involvement and infiltration of the seminal vesicles. On all pre-EBR scans, we could identify a low intensity region in the peripheral zone on T2 weighted images correspondng to the positive biopsy findings (11 cases with tumor confined prostate, 15 cases with signs of extracapsular disease). On post-EBR scans, we obtained a variable pattern of radiation induced changes. In this presentation, the results are detailed and images from the study demonstrated. Endo-MR examination enables excellent morphological evaluation of prostate cancers and shows initial promise in demonstration of post radiation changes.

Key words: prostatic cancer; endorectal magnetic resonance imaging

Introduction

The local extent of prostatic carcinoma is difficult to asses with any conventional imaging modality. The development of a magnetic resonance endorectal surface coil (Endo-MR) has significantly enhanced the details with which the prostate and the surrounding structures can be seen.[1,2,3] The Endo-MR surface coil is mounted on a inflatable balloon; the balloon has a concave surface to seat well against the prostate.

The appearance of the prostate and the seminal vesicles on T1 and T2-weighted images is different. T1-weighted images are useful in imaging the periprostatic fat and periprostatic venous plexus; tumors are usually isodense to the normal prostate on T1-weighted images.

T2-weighted images are most useful in demonstrating the internal architecture of the prostate and seminal vesicles. The central gland is of relatively low signal, whereas the peripheral zone is of high signal. Carcinoma of the prostate presents a low signal area on T2, most commonly in the peripheral zone.

The purpose of this prospective study is to asses the value of endorectal surface coil magnetic resonance (Endo-MR) in the monitoring of patients with prostate cancer before and after external beam radiation (EBR) and to compare the imaging findings to clinical data.

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Materials and methods

Since August 1994, clinical and laboratory data (including PSA, chest x-ray, bone scan, CT of the

pelvis) were obtained on twenty-six patients (57-74 years, median 68 years) with biopsy proven prostate cancer and no evidence of distant metastases. All patients underwent Endo-MR imaging prior to external beam radiation (pre-EBR). The time interval between biopsy and MR examination was more than three weeks to ensure better differentiation between biopsy-related small areas of haemorrhage within or adjacent to the prostate and tumour-related signal intensity changes. EBR was delivered by high energy photon beams with a continuous course of 70 Gy/35-38 fx/5 days a week with a three- or four-field technique. Six months after EBR, another Endo-MR, examination was performed in fourteen patients (post-EBR) until date. We used a 1.5 Tesla unit (Gyroscan ACS, Philips) performing T1-weighted (TRE 627, TE 14) and T2-weighted (TR 2700, TE 120) spin echo or fast spin echo sequences in axial and coronal planes (slide thickness of 3 mm, FOV 210 mm). Imaging analysis of both pre- and post-EBR scans included the assessment of tumor size, prostate capsule involvement, infiltration of the neurovascular bundle and the seminal vesicles.

Results

In all 26 pre-EBR-examinations, we were able to identify a low signal intensity region in the peripheral zone corresponding to the positive biopsy findings.

In eleven patients, the tumor was confined to the prostate, but in these patients, surgery was not performed for cardiovascular or other medical reasons. In fifteen patients, evidence of extracapsular disease was observed on pre-EBR scans.

Similar to other authors,[4] we obtained a variable pattern of changes at post-EBR scans. Concerning tumor morphology, we found residual tumors of decreased size in six patients. Two tumors could no longer be identified after irradiation and one tumor could not be evaluated due to diffuse signal loss of the entire gland. No changes in tumor size and signal intensity were found in five patients; two of them had concurrent hormonal therapy.

Changes in gland morphology after EBR were observed in five patients. Increased signal on T2-weighted images in the peripheral zone and central gland was found in two patients, decreased signal in the peripheral zone in two other patients and - as described above - a uniform very low signal intensity throughout the gland on T2-weighted images was seen in one patient.

PSA levels were decreased in all patients after EBR.

Conclusion

Endo-MR provides important information for radiotherapy planning by accurate tumor staging and seems to be capable to demonstrate post radiation changes in patients with prostate cancer.

References

1. Schnall MD, Lenkinski RE, Pollack HM, Imai Y, Kressel HY. Prostate: MR imaging with an endorectal surface coil. *Radiology* 1989;**172:** 570.

2. Schnall MD, Imai Y, Tomaszewski JE, Pollack HM, Lenkinski RE, Kressel HY. Prostate cancer: local staging with endorectal surface coil MR imaging. *Radiology* 1991; **178:** 797.

3. Jager GJ, Barentsz JO, de la Rosette JJ, Rosenbusch G: Preliminary results of endorectal surface coil magnetic resonance imaging for local staging of prostate cancer. *Radiology* 1994; **34:** 129-33.

4. Underberg-Davis SJ, Schnall MD, Whittington R, Kressel HY, Pollack H. Endorectal MR Imaging of Prostate Carcinoma After Radiation Therapy. In: Book of abstracts: 11th Annual scientific meeting of the Society of magnetic resonance in medicine. Vol 1. Berlin: 1992: 129.