MAGNETIC RESONANCE SPECTROSCOPY-GUIDED TRANSPERINEAL PROSTATE BIOPSY AND BRACHYTHERAPY FOR RECURRENT PROSTATE CANCER

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ABSTRACT

Brachytherapy targeted to the peripheral zone with magnetic resonance imaging (MRI) guidance is a prostate cancer treatment option with potentially fewer complications than other treatments. Follow-up MRI when failure is suspected is, however, difficult because of radiation-induced changes. Furthermore, MR spectroscopy (MRS) is compromised by susceptibility artifacts from radioactive seeds in the peripheral zone. We report a case in which combined MRI/MRS was useful for the detection of prostate cancer in the transitional zone in patients previously treated with MR-guided brachytherapy. We propose that MRI/MRS can help detect recurrent prostate cancer, guide prostate biopsy, and help manage salvage treatment decisions. UROLOGY 66: 1319.e13–1319.e15, 2005. © 2005 Elsevier Inc.

Prostate-specific antigen (PSA) levels after brachytherapy for localized prostate cancer are used as a measure of disease recurrence. PSA failure occurs in approximately 24% of patients within 13 years after treatment.1 Radiation-induced changes of the prostate gland are known to cause difficulties in defining the exact location of recurrent disease by magnetic resonance imaging (MRI) alone. MRI in conjunction with MR spectroscopy (MRS) might, however, overcome these difficulties.

CASE REPORT

A 61-year-old man was referred to our hospital after a PSA screening result of 5 ng/mL. He underwent transrectal ultrasound (TRUS)-guided prostate biopsy that revealed the presence of adenocarcinoma with a Gleason sum of 6/10 and Gleason score of 3 + 3. The patient opted to undergo MR-guided prostate interstitial brachytherapy. Four years after the initial treatment, the patient presented with a PSA level of 8.7 ng/mL. MRI revealed postra diotherapy changes but no area of recurrence in the peripheral zone (PZ). MRS showed an area of abnormal metabolic activity with an elevated (choline + creatine)/citrate ratio of 1.23 to 3.10 in the anterior transitional zone (TZ) at the base, midgland, and apex (Fig. 1). Retrospective review of the combined MRI and MRS films showed an abnormal area of low T2-weighted signal in the same location suspected from MRS. MR-directed biopsy using an 18-gauge biopsy gun was performed in a 0.5-Tesla magnet (GE Signa SP, GE Healthcare, Milwaukee, Wis) with sextant sampling of the PZ and targeted sampling of four suspicious regions identified from MRS in the anterior TZ and anterior fibromuscular regions.2 To guide the needle biopsy accurately, prebiopsy T2-weighted images and manually contoured suspect MRS regions were co-registered with intraoperative real-time MRI and displayed in the bore of the magnet to guide the physicians performing the biopsy. The pathology results showed prostate cancer in two of the targeted regions and in the right base of the PZ. The
patient subsequently underwent salvage MR-guided prostate interstitial brachytherapy targeting the PZ and anterior part of TZ that contained tumor as identified by MRS and confirmed by needle biopsy.

**COMMENT**

Radiation-induced changes of the prostate decrease the $T_2$-weighted signal intensity, making detection of recurrent or residual cancer difficult with MRI alone. Previous studies have shown MRI combined with MRS to be useful in the detection of recurrent or residual cancer after cryosurgery and external beam radiotherapy.\(^3\)\(^-\)\(^5\) In the case of MR-guided brachytherapy specifically targeting the PZ, susceptibility artifacts from the seeds make it difficult to assess changes in the PZ with MRS, although metabolic changes in the TZ and elsewhere can be evaluated. In this case, MRS proved useful for identifying cancer outside the PZ, in the anterior TZ, a region not routinely sampled by either TRUS or MR-guided biopsy methods. This case demonstrates the utility of MRS for detecting residual or recurrent prostate cancer in the TZ in patients whose PZ had been previously treated with brachytherapy. The use of MRS will always be limited in regions in which brachytherapy seeds are placed.

**FIGURE 1.** (A) Image registration of $T_2$-weighted axial image acquired in 1.5-Tesla scanner to real-time axial image in 0.5-Tesla scanner. White arrow indicates location of spectroscopy-detected lesion in anterior TZ. (B) Real-time axial image of MR-guided prostate biopsy of spectroscopy-detected lesion in anterior TZ. White arrow indicates tip of biopsy needle. (C) MRS showing abnormal metabolic activity in anterior TZ (white ellipse). (D) Image segmentation using three-dimensional Slicer surgical navigation software. Target region (white) identified on $T_2$-weighted image acquired in 0.5-Tesla scanner for MR-guided brachytherapy planning.
However, even with TRUS-guided treatment, very few seeds are placed in the anterior TZ, making MRS a viable cancer detection tool. Although MRS will be of limited value in cases in which the whole gland has been treated with seeds because of susceptibility artifacts, we suggest that, in general, it may be useful for detecting recurrent prostate cancer and for guiding prostate biopsy and treatment.

REFERENCES


