

A Case of Hemi-ablation with High-intensity Focused Ultrasound for a Localized Reduced Solitary Lesion in the Prostate

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Recently, effectiveness of local treatment for oncological outcomes for patients with metastatic prostate cancer (PC) has been reported. We performed hemi-ablation with high-intensity focused ultrasound (HIFU) for a patient with a localized reduced solitary lesion in the prostate, which was diagnosed with magnetic resonance imaging (MRI)-transrectal ultrasound fusion image-guided target biopsy with PSA level of 0.24 ng/mL, after androgen receptor signaling inhibitors (ARSIs) and chemotherapy for metastatic PC. Prostate specific antigen levels decreased to 0.01ng/mL at 1 month after the treatment, and cancer suspicious lesion disappeared on MRI. During the follow-up of 24 months, there was no elevation of PSA level with no severe complication related to the treatment. HIFU has possibility to be an effective and minimally invasive treatment as a local treatment for the localized reduced solitary lesion in the prostate after ARSIs and chemotherapy for metastatic PC.

Key words: castration-resistant prostate cancer, diffusion-weighted whole-body imaging, high-intensity focused ultrasound

INTRODUCTION

Systematic treatment with pharmacotherapy is the mainstay of treatment for metastatic castration-resistant prostate cancer (mCRPC), which includes androgen receptor signaling inhibitors (ARSIs) drugs, chemotherapy, immunomodulatory therapy, and radiopharmaceuticals. These treatments demonstrate efficacy in prolonging survival of the patient. Recently, the effectiveness of the local treatment for oligometastasis, which was defined as a limited number of metastatic spots while all other metastases remain controlled by systemic therapy, for prolonging overall survival have been reported [1, 2], by the development of diagnostic imaging technologies for the detection of metastasis, such as diffusion-weighted whole-body imaging (DWIBS) and prostate specific membrane antigen PET-CT.

High-intensity focused ultrasound (HIFU) focuses ultrasound energy to the targeted tissue, which leads to necrosis [3]. Recently, HIFU has been mainly used as a modality of focal therapy for localized PC [3]. We report a short term clinical result of hemi-ablation with HIFU for a patient with a localized reduced solitary lesion in the prostate after systematic treatment with ARSIs agent and chemotherapy for metastatic PC. To the best of our knowledge, this is first report regarding treatment of a solitary lesion in the prostate with HIFU after systematic treatment for patients with metastatic

PC.

CASE PRESENTATION

In 2017, a 77-year-old man presented with a serum prostate-specific antigen (PSA) level of 1056 ng/mL. Using a transrectal prostate biopsy, magnetic resonance imaging (MRI), computed tomography (CT), and bone scintigraphy (BS), the patient was diagnosed with metastatic prostate cancer of which Gleason's score is 8(4 + 4). Distant metastases were observed in the lumbar spine, clavicle, ribs, pelvic bones, femur, and multiple pelvic lymph nodes. No visceral metastasis was observed. The clinical course of the patient is shown in Fig. 1. After the diagnosis, combined androgen blockade therapy was initiated and external radiation therapy (30 Gy) was administered for the metastatic lesion of the fourth lumbar spine, where pathological fractures were observed. The PSA level decreased to 0.3 ng/mL in February 2018 and increased to 0.64 ng/mL in June 2018. At that time, the serum testosterone level was less than 0.5 ng/dl. Although the PSA value did not reach 1.0 ng/mL, we diagnosed it as mCRPC according to the Prostate Cancer Working Group 3 definition [4] as the PSA value had increased by more than 25% of the previous value within two consecutive measurements separated by a month (0.40, 0.50, and 0.64) and was expected to reach 1.0 ng/mL in the future. After the diagnosis of mCRPC, Enzalutamide treatment was administered for 8 months that

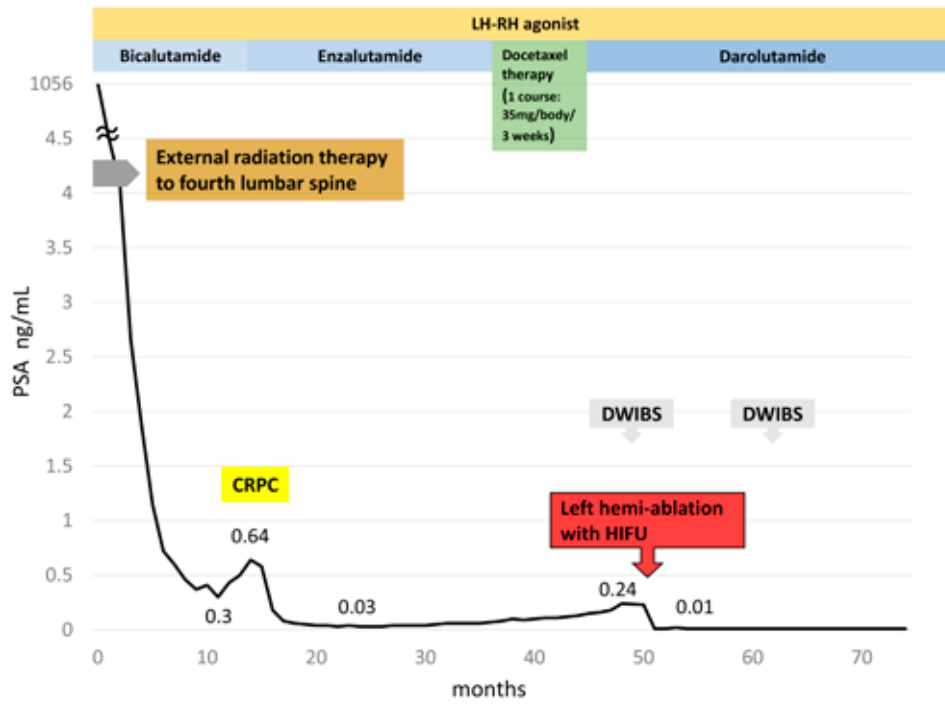


Fig. 1 Clinical course of the patient is shown in the figure. After systematic treatment with an androgen receptor-axis-targeted agent and chemotherapy, the prostate specific antigen (PSA) level decreased from 1056 ng/mL to 0.03 ng/mL. The PSA level elevated again to 0.24 ng/mL, and significant cancer was detected in the prostate by target biopsy after the systematic treatment. Thereafter, the PSA level decreased to 0.01 ng/mL following focal ablation with high-intensity focused ultrasound for the solitary lesion in the prostate.

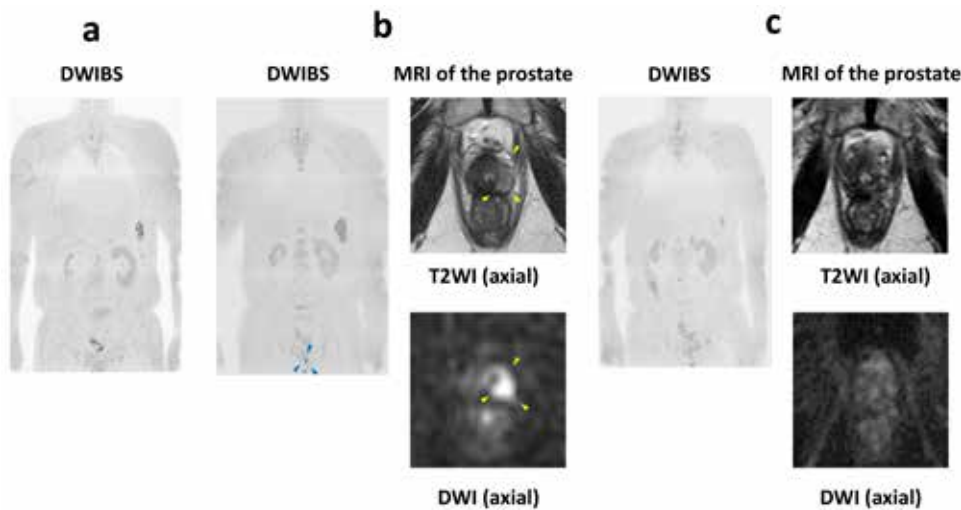


Fig. 2 After docetaxel therapy, no worsening of metastasis was registered on diffusion-weighted whole-body imaging (DWIBS) (Fig. 2a). Before the treatment with high-intensity focused ultrasound (HIFU), a high-signal region was detected in the left lobe of the prostate on DWIBS and MRI of the prostate (Fig. 2b). At 12 months after left hemi-ablation with HIFU, there was no cancer suspicious region on DWIBS and MRI of the prostate (Fig. 2c).

decreased the PSA level to 0.03 ng/mL; however, docetaxel therapy (1 course: 35 mg/body/3 weeks) was initiated in April 2020 for elevated PSA. After 7 courses of docetaxel therapy, DWIBS showed no worsening of metastases and continued shrinkage (Fig. 2a). After informed consent was obtained, darolutamide was used in the broad definition of non-metastatic CRPC. However, the PSA level increased to 0.24ng/mL in April 2021. A high-signal region was detected in the

apex of the left lobe of the prostate using DWIBS (Fig. 2b); therefore, an MRI-transrectal ultrasound (MRI-TRUS) fusion image-guided target biopsy of the region and 12-core systematic biopsies with transperineal approach were performed. In the biopsy cores, adenocarcinoma was diagnosed from only target biopsy core. After obtaining informed consent from the patient, left hemi-ablation with HIFU was performed, and the PSA level of the patient decreased to 0.01 ng/mL at 1

month after the treatment. Darolutamide therapy was continued after the treatment, and PSA levels were not elevated for 24 months, and there was no cancer suspicious region on DWIBS at 12 months after the treatment. (Fig. 2c) During the follow-up of 24 months, no serious complications were observed.

DISCUSSION

The usefulness of treatment for oligometastasis in patients with mCRPC has been previously reported [1, 5]. Based on the imaging diagnosis, surgery or radiotherapy was performed for each metastatic lesion [5]. After the treatment for oligometastasis in 30 patients with mCRPC, the median systemic treatment-free survival and progression-free survival were 16 months and 10 months, respectively [1]. Although the localized reduced solitary lesion was diagnosed in the prostate in the present case, biochemical progression-free survival was confirmed for 24 months after the treatment. The short-term result of the present study suggests that the treatment for a localized reduced solitary lesion in the prostate has possibility to contribute a cancer control after systematic treatment for metastatic PC.

DWIBS is a diagnostic imaging technology used to identify primary and metastatic lesions of PC, and its sensitivity to metastatic lesions is superior to CT and BS, as reported previously [6]. In another study, it was reported that DWIBS can detect new lesions with only slight change in the PSA level of mCRPC patients [7]. Further, it could delineate reduction in the lesion size immediately after local treatment [7]. Based on these previous findings, we evaluated the effect of treatment using DWIBS. In the present case, the localized reduced solitary lesion in the prostate disappeared after the treatment as observed on DWIBS, and the PSA level decreased to 0.01 ng/mL.

Recently, HIFU has been used for focal therapy for localized PC, which allows a distinct margin between the treated and the adjacent untreated tissue [3, 8]. We performed the focal therapy with HIFU for the solitary lesion which was located in the apex portion of the left lobe of the prostate by the MRI-TRUS fusion image-guided target biopsy and systematic biopsy. After the treatment, there was no complications such as urinary retention, urethral stricture, urinary incontinence, and recto-urethral fistula. In the present case, there was no visible metastasis on DWIBS for 12 months after the treatment, and PSA levels remained low for 2 years after the treatment.

Recently, the preclinical and clinical results of HIFU tumor ablation showed that coagulative necrosis and subcellular fragmentation induced infiltration and activation of CD4+ and CD8+ T-cells [9]. Therefore, we expected that these immune effect has possibility to contribute to improve the oncological outcomes for metastatic PC. Further investigation of the immune reaction for PC after HIFU is expected.

CONCLUSION

We reported a short-term clinical result of hemi-ablation with HIFU for a patient with a localized reduced solitary lesion in the prostate after ARSIs for metastatic PC. During the follow-up of 24 months, there was no elevation of PSA level with no severe complication related to the treatment. HIFU has possibility to be an effective and minimally invasive treatment as a local treatment for the localized reduced solitary lesion in the prostate after ARSIs and chemotherapy for metastatic PC.

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ETHICAL STATEMENTS

Informed consent from the patient and ethics review board approval has been obtained.

We also obtained consent for publication from the patient.

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