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CORRELATION BETWEEN PROSTATIC VOLUME CHANGE AND LOWER URINARY TRACT SYMPTOMS AFTER LOW-DOSE RATE BRACHYTHERAPY FOR PROSTATE CANCER

Hypothesis/aims of study

Many studies have demonstrated favorable long-term biochemical outcomes of low-dose rate brachytherapy (LDRB) and have reported biochemical freedom from disease recurrence for stage T1 – T2 prostate cancer following LDRB. LDRB is generally reported to be well tolerated. However, lower urinary tract symptoms (LUTS) often occur following LDRB seed implantation. LUTS are common problems that affect quality of life (QOL) after LDRB for prostate cancer. As the natural course after LDRB, the LUTS peak at 1 – 3 months, begin to fall by 6 months, and return to baseline by 12 months after implantation (1). The presumed causes of LUTS after LDRB are the traumatic effect of needle insertion, seed implantation, and inflammatory changes in the urethra and prostate following radiation exposure (2). However, the mechanisms and processes of LUTS after LDRB have not been confirmed. Aoki et al. reported that prostate volume increased to 173% due to edema of the prostate on the first day after implantation, and decreased by 30% in 2 weeks (3). Although LUTS after LDRB usually reach a peak at 1 – 3 months, edema of the prostate peaks within 2 weeks. Therefore, edematous changes just after implantation of LDRB cannot explain the mechanisms of LUTS after LDRB. We hypothesized that the main cause of LUTS after LDRB may not be edema or inflammation of the prostate but atrophic changes induced by radiological damage to the prostate tissue. This retrospective study was performed to investigate changes in prostate volume and the processes underlying LUTS and inflammation of the LUT after LDRB, and to clarify the causes of LUTS induced by LDRB.

Study design, materials, and methods

Patients undergoing LDRB from 2013 to 2016 were retrospectively enrolled in this study. International Prostate Symptom Score (IPSS), IPSS-QOL, Overactive Bladder Symptom Score (OABSS), uroflowmetry including voided volume (VV), maximum flow rate (Qmax), residual urine volume (RUV), and prostate volume (PV) were evaluated at the preimplantation stage and at 1, 3, 6, 9, and 12 months after implantation of LDRB. PV was measured by transabdominal ultrasound by a single ultrasonographer. Blood and urine tests were performed to evaluate the inflammatory effects of LDRB.

Results

Seventy-six patients with prostate cancer were enrolled in this study. The basic clinical characteristics of the patients are shown in Table 1. After implantation of the LDRB seed, alpha-blocker and/or phosphodiesterase type 5 inhibitor were routinely prescribed in all patients to reduce LUTS.

The clinical courses of LUTS and PV after implantation are shown in Table 2. IPSS, IPSS-QOL, OABSS, and RUV deteriorated from 1 to 3 months after LDRB, and improved to the preoperative levels within 1 year. In contrast, PV decreased by 1 month, and reached the lowest level at 3 months, returning to the preoperative level 12 months after implantation.

The courses of IPSS and PV are shown in Figure 1. Until 3 months after LDRB, IPSS became worse and PV decreased. Little positive relationship was observed between changes in IPSS and PV 3 months after implantation ($r = 0.27$) as shown in Figure 2. After LDRB, only five patients showed microscopic hematopyuria (WBC > 10/HPF or RBC > 10/HPF) and only two patients showed marked inflammatory reactions (CRP > 0.50 mg/dl or WBC > 9000/μl) on urine and blood tests.

Table 1. The basic clinical characteristics of the enrolled 76 patients

Patient		
Age(y.o.)	69 ± 6.0	
PSA(ng/mL)	6.06 ± 1.40	
Distribution of patients		
Gleason Score(GS)	GS3+3	41
	GS3+4	35
T stage	T1c	48
	T2a	23
	T2b	3
	T2c	2
Pretreatment	Hormonal therapy	23
	Alpha-blocker	8

Table 2. Changes of LUTS and Prostate volume after LDRB (Mean±SD)

	pre	1 month	3 months	6 months	9 months	12 months
IPSS						
Total	7.0±4.8	15.1±8.6	16.7±8.2	12.9±8.5	9.7±7.0	6.5±6.0
Volding symptom score	2.6±2.5	6.9±4.5	7.6±4.4	5.8±4.3	4.3±3.6	2.6±2.9
Storage symptom score	3.6±2.3	6.3±3.6	7.0±3.4	5.7±3.5	4.3±3.6	3.2±2.8
Post-voiding symptom score	0.75±0.93	1.9±1.7	2.1±1.6	1.5±1.5	1.1±1.1	0.70±0.86
IPSS-QOL	2.4±1.5	3.7±1.5	4.0±1.4	3.5±1.3	3.0±1.3	2.3±1.3
OABSS	1.6±1.9	3.8±3.4	4.3±3.8	4.0±4.0	3.3±3.2	2.4±2.7
Uroflowmetry						
Voided Volume (mL)	384±180	274±124	253±122	268±104	262±104	268±126
Qmax (mL/s)	20±8.5	12±6.4	13±6.7	14±6.3	14±6.7	16±8.6
Residual urine volume (mL)	29±70	38±45	41±44	40±45	28±38	18±24
Prostate volume(cm^3)	20.2±7.3	18.8±6.5	18.7±6.3	19.0±7.0	20.1±7.8	20.4±7.42

Figure 1. Changes of IPSS and prostate volume

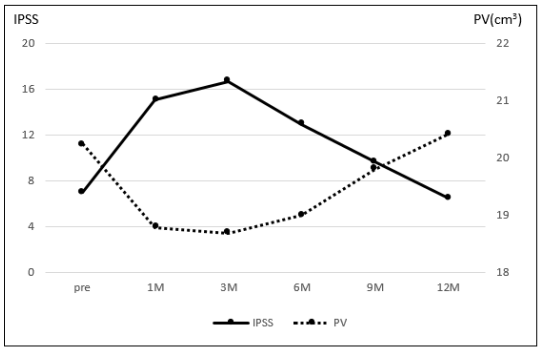
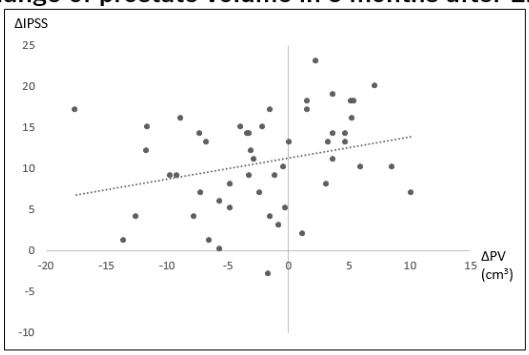


Figure 2. Correlation between IPSS change and change of prostate volume in 3 months after LDRB



Interpretation of results

LUTS reached a peak at 3 months after LDRB, synchronizing with the decrease in PV. From 3 months to 1 year after LDRB, LUTS improved as PV recovered. These results indicated that the severity of LUTS after LDRB is not associated with prostate enlargement induced by edema, hematoma, or inflammation after LDRB. Atrophic changes in the prostate induced by radiation may influence LUTS. Factors resulting in prostatic volume reduction, such as disorder of prostatic microcirculation, should be considered as the main cause of LTUS after LDRB. However, no strong correlation was observed between prostatic volume reduction and IPSS change in this study. Therefore, factors that are not associated with prostatic volume change should also be considered as causes of LUTS after LDRB. Theoretically, strong levels of radioactivity remain for almost 3 months after LDRB. Therefore, direct nerve damage by radiation may be associated with LUTS after LDRB.

Concluding message

The severity of LUTS after LDRB is synchronized with the decrease in PV. Edematous and inflammatory changes in the prostate may be excluded as a mechanism of LUTS after LDRB.

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Disclosures

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