



Chronological changes in lower urinary tract symptoms after carbon-ion radiotherapy for prostate cancer patients

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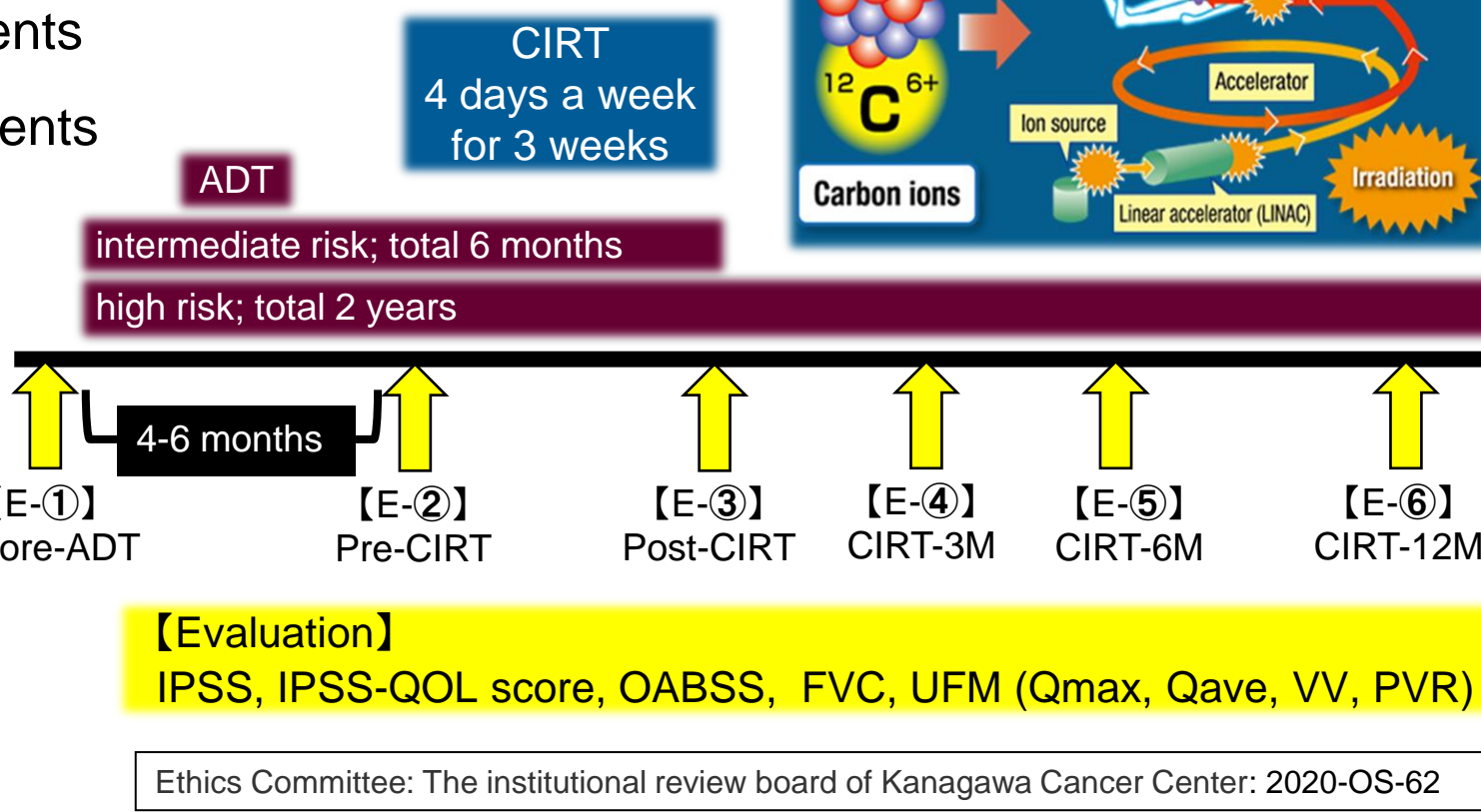
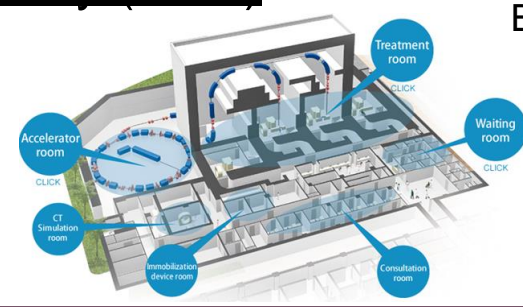
Hypothesis / Aims of study:

- ▶ RT is one of the treatment strategies for localized prostate cancer
- ▶ CIRT is superior to X-ray-based RT, and favorable clinical outcomes of CIRT for localized prostate cancer have been reported
- ▶ Radiation-induced complications may occur after CIRT, adversely affecting the QOL of the patients
- ▶ No reports using objective assessment of chronological changes in lower urinary tract complications after CIRT

→ To clarify the chronological changes in LUTS after CIRT for prostate cancer patients

Study design / Methods:

- ▶ A prospective study for patients scheduled to undergo CIRT for prostate cancer
- ▶ Informed consent was obtained from 221 patients
- ▶ Statistical analysis was performed on 169 patients who did not drop out by the first year
- ▶ CIRT was performed once a day, 4 days a week for 3 weeks, for a total dose of 51.6 Gy (RBE)



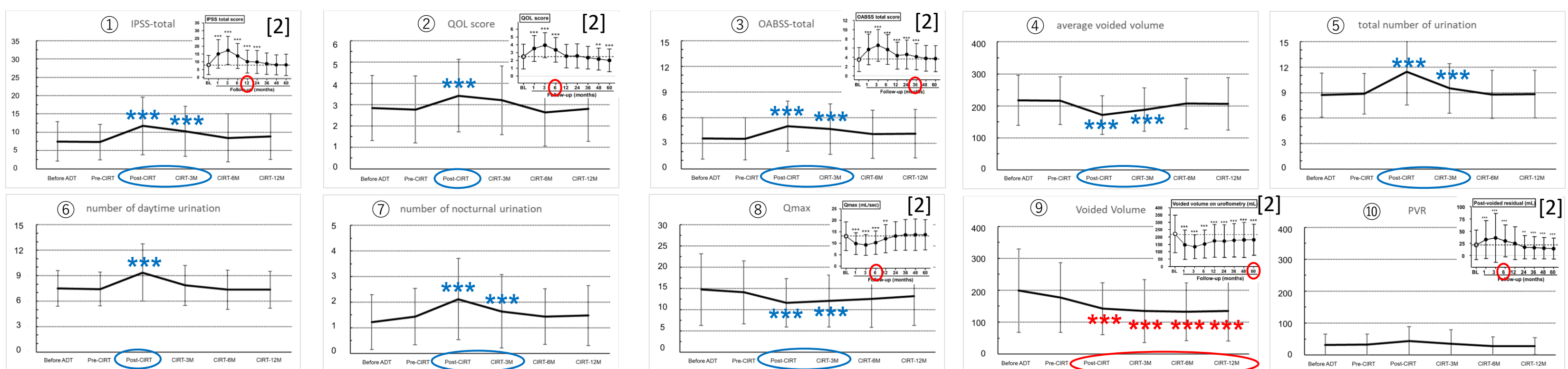
characteristics of the patients n = 169		
Age	average (range)	71.1 ± 7.4 (46-87)
T stage	T1c	18
	T2a	78
	T2b	6
	T2c	34
	T3a	26
T3b	7	
Pre-treatment PSA (ng/mL)	average (range)	10.4 ± 9.2 (2.2-67)
	< 10	110
	10 ~ 20	45
Gleason Score	20 <	14
	6	8
	7	88
	8	48
	9	25
10	0	
D'Amico classification	Low	3
	Intermediate	62
	High	104
PV (mL) (Prostate Volume)	average (range)	30.1 ± 15.5 (12.6-133)
	20 <	14

Results:

	n=169	before ADT	pre-CIRT	post-CIRT	CIRT-3M	CIRT-6M	CIRT-12M
IPSS	IPSS-1	0.64 ± 1.00	0.61 ± 0.87	1.11 ± 1.42 ***	1.04 ± 1.23 ***	0.80 ± 1.10	0.89 ± 1.18
	IPSS-2	1.70 ± 1.38	1.65 ± 1.42	2.28 ± 1.64 ***	2.08 ± 1.63 *	1.86 ± 1.50	1.82 ± 1.51
	IPSS-3	0.94 ± 1.35	0.81 ± 1.21	1.56 ± 1.70 ***	1.25 ± 1.50	1.04 ± 1.48	1.04 ± 1.37
	IPSS-4	0.75 ± 1.06	0.71 ± 1.06	1.19 ± 1.35 ***	1.01 ± 1.29	0.91 ± 1.24	0.90 ± 1.15
	IPSS-5	1.36 ± 1.48	1.16 ± 1.43	2.23 ± 1.88 ***	1.82 ± 1.63 **	1.34 ± 1.55	1.54 ± 1.60
	IPSS-6	0.50 ± 0.94	0.53 ± 1.00	1.14 ± 1.53 ***	0.84 ± 1.21 *	0.64 ± 1.15	0.65 ± 1.04
	IPSS-7	1.63 ± 1.00	1.83 ± 1.11 *	2.22 ± 1.24 ***	2.17 ± 1.25 ***	1.87 ± 1.10 **	1.97 ± 1.16 ***
IPSS-total ①	7.48 ± 5.43	7.29 ± 4.88	11.71 ± 7.84 ***	10.23 ± 6.87 ***	8.46 ± 6.61	8.82 ± 6.27 *	
IPSS-QOL ②	2.84 ± 1.52	2.78 ± 1.57	3.43 ± 1.71 ***	3.21 ± 1.62	2.64 ± 1.58	2.80 ± 1.52	
OABSS	OABSS-1	0.69 ± 0.52	0.61 ± 0.49	0.89 ± 0.52 **	0.73 ± 0.56	0.66 ± 0.56	0.69 ± 0.52
	OABSS-2	1.48 ± 0.90	1.64 ± 0.87	1.96 ± 0.91 ***	1.89 ± 0.92 ***	1.78 ± 0.93 ***	1.72 ± 0.92 ***
	OABSS-3	1.05 ± 1.27	0.95 ± 1.29	1.59 ± 1.54 ***	1.45 ± 1.45 *	1.17 ± 1.38	1.22 ± 1.34
	OABSS-4	0.34 ± 0.74	0.31 ± 0.71	0.56 ± 1.01	0.57 ± 1.01	0.44 ± 0.88	0.49 ± 0.94
OABSS-total ③	3.55 ± 2.42	3.52 ± 2.46	5.00 ± 2.94 ***	4.65 ± 2.94 ***	4.06 ± 2.82 *	4.12 ± 2.85 **	
FVC	urine volume per day (mL)	1802.0 ± 601.0	1822.8 ± 554.8	1837.4 ± 591.4	1703.3 ± 557.1	1726.6 ± 584.2	1719.1 ± 559.5
	average voided volume (mL) ④	217.7 ± 77.9	216.2 ± 75.1	171.3 ± 60.8 ***	188.4 ± 68.2 ***	207.2 ± 78.9	206.6 ± 81.8
	total number of urination ⑤	8.70 ± 2.59	8.86 ± 2.39	11.48 ± 3.91 ***	9.50 ± 2.90 ***	8.79 ± 2.81	8.83 ± 2.79
	number of daytime urination ⑥	7.49 ± 2.11	7.42 ± 1.99	9.36 ± 3.37 ***	7.86 ± 2.35	7.35 ± 2.33	7.35 ± 2.18
	number of nocturnal urination ⑦	1.21 ± 1.07	1.44 ± 1.10	2.12 ± 1.59 ***	1.64 ± 1.44 ***	1.44 ± 1.09 **	1.48 ± 1.17 *
NPI (%)	33.4 ± 12.0	35.0 ± 13.3	35.0 ± 14.4	35.8 ± 13.7	36.2 ± 13.4 **	36.7 ± 14.2	
UFM	Qmax (mL/s) ⑧	14.8 ± 8.4	14.1 ± 7.4	11.6 ± 5.7 ***	12.1 ± 6.1 ***	12.5 ± 6.7 **	13.2 ± 6.9 *
	Qave (mL/s)	8.8 ± 4.5	8.3 ± 4.1	7.0 ± 3.0 ***	7.5 ± 3.5 ***	7.7 ± 3.9 *	8.1 ± 4.0 *
	voided volume (mL) ⑨	198.7 ± 130.8	177.2 ± 109.2	142.3 ± 81.2 ***	134.9 ± 98.8 ***	132.8 ± 90.8 ***	135.7 ± 95.1 ***
	PVR (mL) ⑩	31.4 ± 34.1	32.6 ± 33.0	43.3 ± 45.6 *	35.7 ± 43.4	28.4 ± 28.5	27.5 ± 26.6

Chi-square tests were used to compare individual data between baseline and each assessment time point, and the Bonferroni method was used to adjust for multiple comparisons.

* P<0.05
 ** P<0.01
 *** P<0.001



Interpretation of results:

- ▶ The worsening of LUTS peaked immediately after CIRT and showed a tendency to improve 3 months after CIRT, except for VV on UFM
- ▶ Storage symptoms persist longer than voiding symptoms
- ▶ Recovery from LUTS was faster with CIRT than with BT, likely due to radiation dose and bladder irradiation
- ▶ Limitations: This clinical study was a short-term follow-up study and was not a randomized controlled trial
- ▶ Knowing the chronological changes in LUTS on CIRT may help patients make better-informed decisions for treatment

Conclusions:

- ▶ This is the first prospectively study to investigate chronological changes in LUTS over 1 year period following CIRT
- ▶ Recovery from LUTS was faster with CIRT compared with BT, but storage symptoms persist longer than voiding symptoms
- ▶ We believe that this study will help select treatment options for patients with localized prostate cancer

Abbreviations:

RT: Radiation therapy, CIRT: Carbon-ion radiotherapy, BT: Brachytherapy, LUTS: lower urinary tract symptoms, ADT: Androgen deprivation therapy, IPSS: International Prostate Symptom Score, QOL: Quality of Life, OABSS: Overactive Bladder Symptom Score, FVC: Frequency-volume chart, NPI: Nocturnal polyuria index, UFM: Uroflowmetry, Qmax: Maximum urine flow rate, Qave: Average flow rate, VV: voided volume, PVR: Post-void residual volume

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