

2008 2 20 / 2008 4 18 1 , 2008 5 21 2 / 2008 5 22

:
: 2002 12 2007 8
26 . 13 , CT ,
1 450 cc . 13 .
CT . 3 70.2 Gy 6 - 8
: CT 283.5±114.0 cc (40%) 181.2±120.1
cc (66%) 가 CT CT scan CT 62% .
가 CT 33% 75%
: CT 6-8
:
:

1.

CT , , 가 , 가
가 .
50.4 Gy 80 Gy CT
[1-4]. [11-13].
[5-7].
가 가
가 가
가 [8-10]. 가 [14-20].
3
가 .

가

CT

1

1

6-8

1

2.

2.1 CT

3.

13 (I) 26 (II) 13 26

3.1 CT

CT (I) 100 cc

Fig.

200-300

500

5 mm CT (64-slice Sensation, Siemens)

cc 200 cc

450 cc

1

CT

CT

3

Pinnacle (Philips Medical System 7020)

3

cGy

2.2

13

(128XP, ACUSON)

Fig. 1

1

450 cc

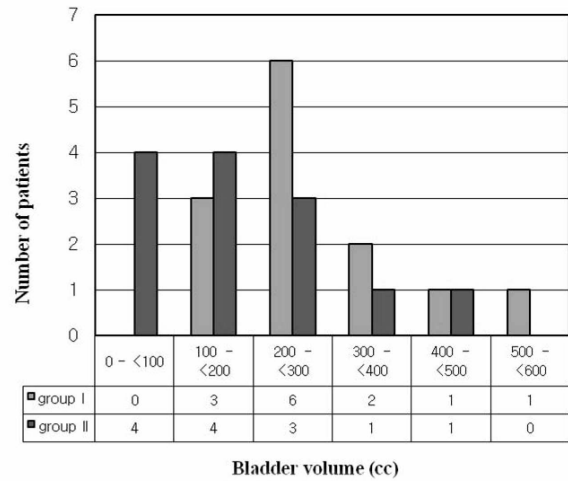


Fig. 2. Bladder volumes measured from CT images (group I: experimental group, group II: control group).

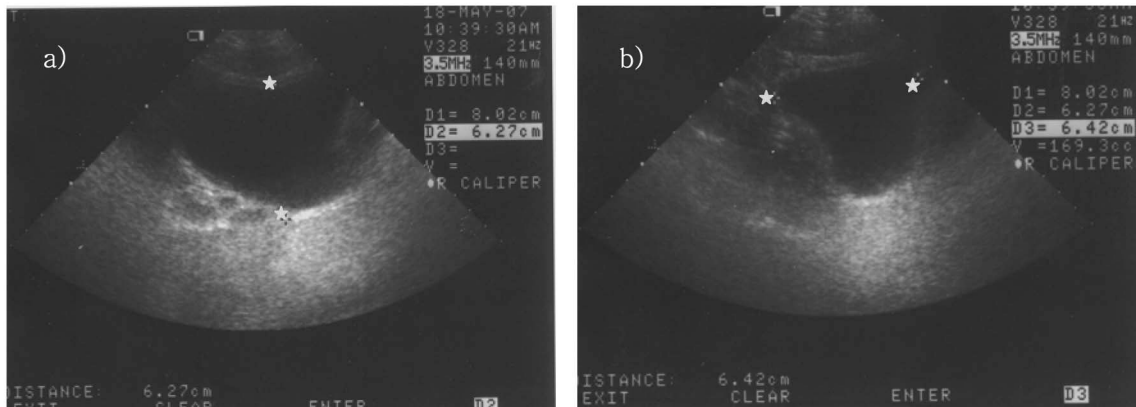


Fig. 1. Ultrasound images used to calculate bladder volumes a) AP and b) Lateral images.

(450 cc) 1 CT
 283.5±114.0 cc 가 1
 63%
 217 cc [21].
 181.2±120.1 cc 가
 3 normal tissue complication
 probability (NTCP) Table 1

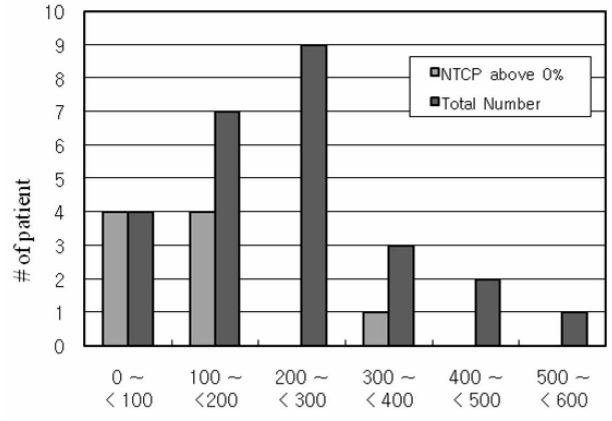


Fig. 3. Number of patients having NTCP above 0 % as a function of bladder volume.

NTCP 3 0 가 4%
 46%가 가
 10%
 3.2
 NTCP (Fig. 3). 0-100 cc 4
 4 (100%) , 100-200 cc
 7 4 (57%) 200
 cc 15 1 CT
 CT 200 cc 가
 CT 283.5±

13 CT
 CT
 Fig. 4 . 1
 CT 가
 CT 283.5±

Table 1. Comparison of effective volumes and NTCPs of bladder in prostate cancer patients.

Patient No	Experimental group		Control group	
	effective vol	NTCP (%)	effective vol	NTCP(%)
1	40.5	0	50.8	0
2	75.1	3	79.7	4
3	73.7	4	61.8	0
4	50.8	0	78.6	3
5	38.3	0	64	0
6	25.9	0	80.6	3
7	39.7	0	76.2	3
8	55.0	0	58.3	0
9	78.0	0	28.6	0
10	37.8	0	47.2	0
11	56.5	0	78.4	4
12	68.1	1	56.5	0
13	49.2	0	82.6	10
Mean	53.0		64.9	
SD	16.6		16.4	

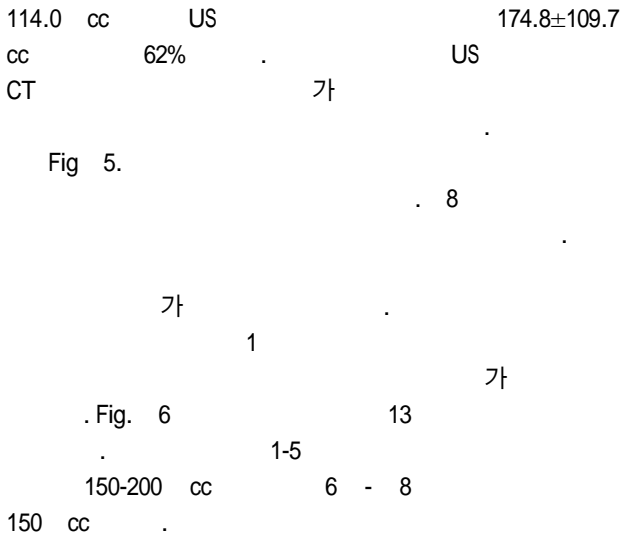


Fig. 5. Bladder volumes measured on CT and Ultrasound images.

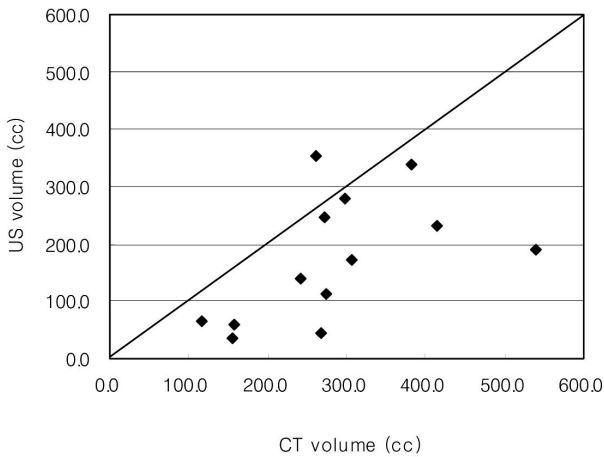


Fig. 4. Bladder volumes measured on CT and Ultrasound images.

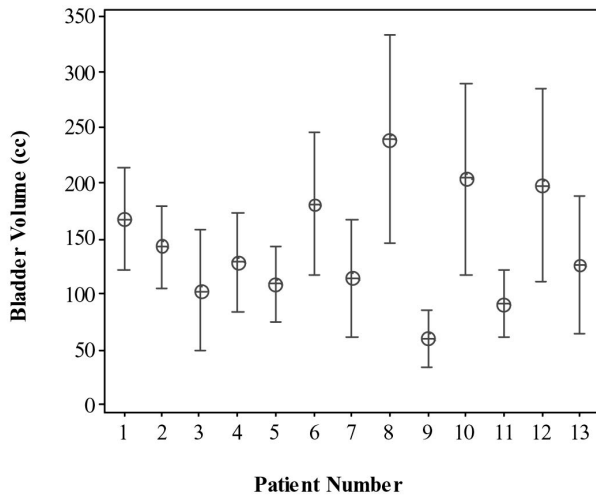


Fig. 5. Bladder volumes measured over time for the 13 patients.

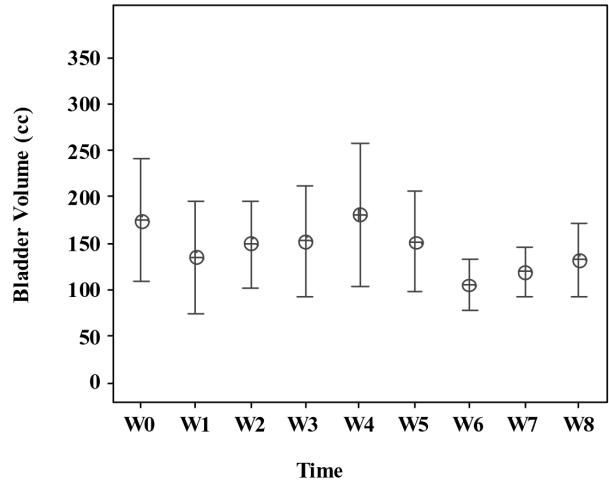


Fig. 6. Average bladder volumes as a function of time.

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Bladder Volume Variations in Patients Receiving Conformal Radiotherapy to Prostate

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Abstract - Objective: To reduce urinary side effects in prostate cancer patients receiving radiation, patients were asked to drink certain amount of water to maintain bladder volume constant and the bladder volumes were measured weekly using ultrasound scanner.

Materials and Methods: Twenty-six patients with prostate cancer who received radiation between December 2002 and August 2007 were enrolled in this study. Thirteen patients were enrolled in experimental group. These patients were asked to drink 450 cc of water, one hour prior to simulation, CT scan, and treatment. The other thirteen patients were given no information about bladder filing. Bladder, prostate, and rectum were contoured on CT and volumes were calculated. 3D conformal treatment planning was performed and effective volumes of bladder were calculated when a prescription dose of 70.2 Gy was delivered. For the patients in experimental group, bladder volumes were measured weekly using ultrasound scanner for 6-8 weeks and the bladder volume variations were analyzed.

Results: Average bladder volumes and standard deviations obtained at CT scanning were 283.5±114.0 cc (40%) and 181.2±120.1 cc (66%) in experimental and control groups, respectively. Although it was not statistically significant, there was correlation between the bladder volumes measured from CT and ultrasound. The volumes measured using ultrasound scanner were 62% lower than the volumes using CT images on average. There was significant variations in volumes measured weekly for 6-8 weeks. It ranged between 33 - 75 %.

Conclusion: Our results showed that it is possible to obtain larger bladder volume if they are asked to drink certain amount of water prior to CT scan. However, patients were unable to maintain constant bladder volumes over the 6-8 weeks of treatment period although they were asked to drink constant amount of water.

Keywords : Prostate cancer, bladder volume, 3D-Conformal Radiotherapy