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Effect of Pelvic Irradiation on the Bone Mineral Content of Lumbar Spine in Cervical Cancer

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Purpose : To evaluate the loss of bone mineral contents(BMC) in lumbar spine within the radiation field for cervical cancer treatment, BMC in the irradiated patient group was compared with that of a normal control group.

Method and materials : Measurements of BMC in the trabecular bone in lumbar spines(L3-L5) were performed in the both patient and normal control groups. Investigators used dual-energy quantitative computerized tomography(DEQCT) using photon energy of 120 and 80kVp. The numbers of patient and control groups were 43 in each with age distribution of fifth to seventh decade of women. The numbers of control group were 22 in fifth, 10 in sixth, and 11 in seventh decade, those of patient group were 14 in fifth, 14 in sixth, and 15 in seventh decade of women. The radiation field was extended to L5 spine for pelvic irradiation with 45-54Gy of external radiation dose and 30Gy of high dose rate brachytherapy in cervical cancer.

Results : The BMC is decreased as increasing age in both control and patient groups. BMC in lumbar spine of patient group was decreased by about 13% to 40% maximally. The BMC of L3 and L4 a region that is out of a radiation field for the patient group demonstrated 119.5 ± 30.6 , 117.0 ± 31.7 for fifth, 83.3 ± 37.8 , 88.3 ± 46.8 for sixth and 61.5 ± 18.3 , 56.2 ± 26.6 mg/cc for seventh. Contrasted by the normal control group has shown 148.0 ± 19.9 , 153.2 ± 23.2 for fifth, 96.1 ± 30.2 , 105.6 ± 26.5 for sixth and 73.9 ± 27.9 , 77.2 ± 27.2 mg/cc for seventh decade, respectively. The BMC of patient group was decreased as near the radiation field, while the lower lumbar spine has shown more large amounts of BMC in the normal control group. In particular, the BMC of L5 within the radiation field was significantly decreased to 33%, 31%, 40% compared with the control group of the fifth, sixth and seventh decades, respectively.

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Conclusion : The pelvic irradiation in cervical cancer has much effected on the loss of bone mineral content of lumbar spine within the radiation field, as the lower lumbar spine has shown a smaller BMC in patient group with pelvic irradiation in contrast to that of the normal control groups.

Key Words: Bone mineral content, Cervical cancer, Radiation therapy, Dual energy quantitative computed tomography

1989 3 1996 3

7.9% 1)

2). Fajardo³⁾ Libshitz⁴⁾ 1994 (Karnofsky performance status)가 80 43

가 ,

(inactivation of bone formation), (bone resorption) 가 40 60 43

3, 4 5

50.6

가 55.3

30 가 40 22 , 50 10 ,

가 60 11 40 14 , 50

14 , 60 15 (Table 1).

5).

Krolner⁶⁾ 1992 가 (stage distribution)

stage 21 , 20 , 2

4500-5400cGy

3000cGy .

34 .

L4-L5

가 , 4 5

(obturator foramen)

(pelvic brim) 2cm

(femur head)

Table 1. Age Distribution of Control and Patient Groups

Age(yrs)	Group	
	Control(No.)	Patient(No.)
40 - 49	22	14
50 - 59	10	14
60 - 69	11	15
Total	43	43

(Dual Energy Quantitative Computed Tomography, DEQCT)

7, 8)

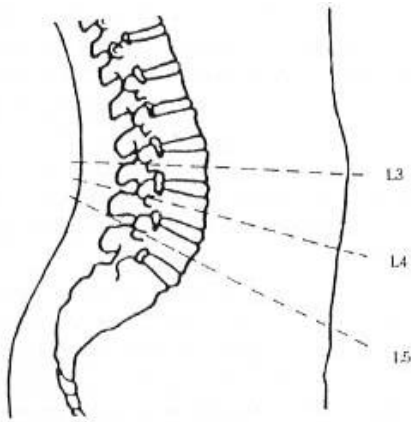


Fig. 1. Schematic diagram of lateral view for axial viewing on lumbar spine in dual energy quantitative computed tomogram.

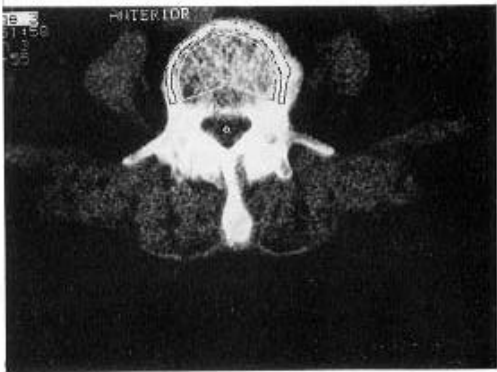


Fig. 2. Contour of region of interest as trabecular and cortical region of the lumbar spine.

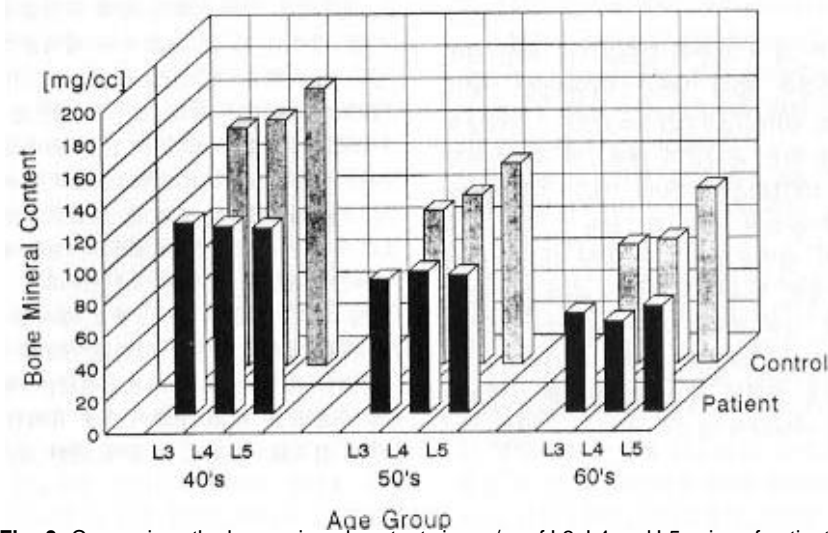


Fig. 3. Comparison the bone mineral contents in mg/cc of L3, L4 and L5 spine of patient to that of the normal women for the control group.

(symphysis pubis)
(sacral bone)

3, 4 5
(Fig. 1).

(120KVp)
(mg/cc)

(80KVp)
(scan)

(lateral topogram)

DEQCT
512 × 512

SOMA TOM-PLUS(Siemens, Germany)

10mm, 1 3

가 40 가

, 50 60

(Fig. 2),

t-test

4

40 153.2±23.2mg/cc, 50 105.6±
26.5 mg/cc, 60 77.2±27.2mg/cc

40 117.0±31.7mg/cc, 50 88.3±
46.9mg/cc, 60 56.2±26.6mg/cc

가 4

가

DEQCT

가 , 40

(P<0.05).

5

가 40 172.3±36.1
mg/cc, 50 125.1±28.3mg/cc, 60 109.1±
41.5mg/cc , 40 115.8±
20.4mg/cc, 50 88.4±48.4mg/cc, 60 65.7±
34.2mg/cc 5

3 5

(Fig. 3).

3 DEQCT

40 148.0±19.9mg/cc, 50
96.1±30.2mg/cc, 60 73.9±27.9mg/cc

가

40 119.5±30.6mg/cc, 50 83.3±
37.8mg/cc, 60 61.5±18.3mg/cc

(Table 2).

33 % 50 60

15% 22% L3, L4

L5 31% 40%

Table 2. Bone Mineral Content(mg/cc) of Trabecular Bone in Lumbar Spines by Age in Control and Patient Groups.

Age(yr)	Measurement Site	Group		% of Loss	Pvalue
		Control	Patient		
0.006 40 - 49	L3	148.0 ± 19.9		119.5 ± 30.6	19.3
	L4	153.2 ± 23.2	117.0 ± 31.7	23.6	0.001
	L5	172.3 ± 36.1		115.8 ± 20.4	32.8
50 - 59	L3	96.1 ± 30.2	83.3 ± 37.8	13.3	0.200
	L4	105.6 ± 26.5	88.3 ± 46.9	16.4	0.200
	L5	125.1 ± 28.3		85.9 ± 48.4	31.3
0.040 60 - 69	L3	73.9 ± 27.9	61.5 ± 18.3	16.7	0.200
	L4	77.2 ± 27.2	56.2 ± 26.6	27.2	0.050
	L5	109.1 ± 42.0		65.7 ± 34.2	39.8
0.009					

40 .

, 50 60
5

(bone resorption)
(loosening)
가
13).

40 13% 2
(3/22), 50 20%(2/10), 60 36%(4/11) . Ataya 14) 1995
40 35%(5/14),
50 57%(8/14), 60 66%(10/15)
가

estrogen (ovarian follicle)
estrogen
estrogen

receptor
(somatomedin c)가
(catabolic

DEQCT 3 (localization)가 bone metabolism)
가 15).

QCT (calcium regulating hormone)
가
가

9).

16, 17)

(trabecular bone)
(cortical bone) 가 , estrogen

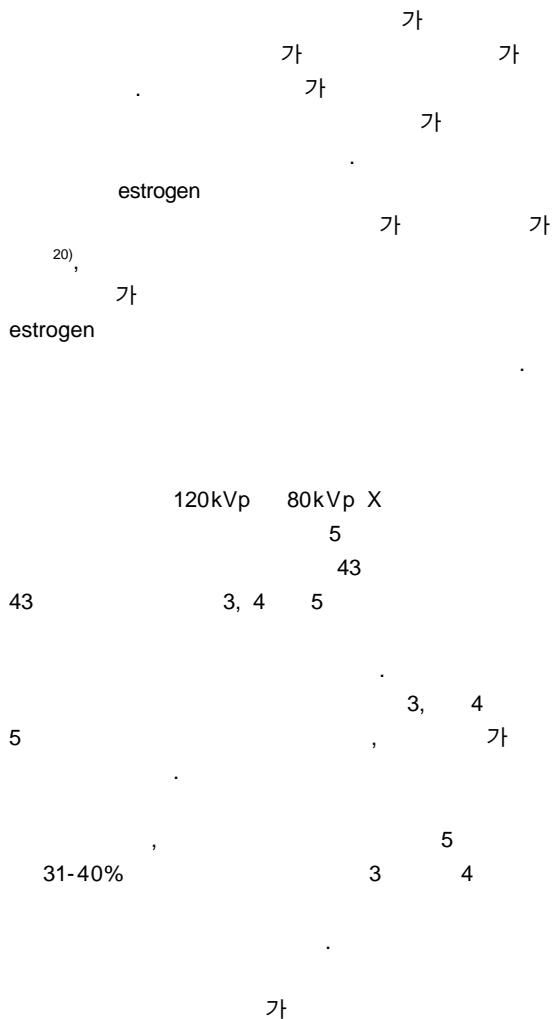
3 가 18, 19)
Estrogen 3-6
가 40-50%
15).

(turnover rate) 8
10).

3, 4 40
19% 24%
5
33% 1
2
, 50 60
가 5
31%, 40%

2 3
12).

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: 120kVp 80kVp X

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43

43

86

40

22

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10

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11

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40

14

, 50

14

, 60

15

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5

45-54Gy

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30Gy

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13%

40%

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3, 4

40

119.5 ± 30.6, 117.0 ± 31.7,

50

83.3 ± 37.8, 88.3 ± 46.8, 60 61.5 ± 18.3, 56.2 ± 26.6mg/cc

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40

148 ± 19.9, 153.2 ± 23.2, 50 96.1 ± 30.2, 105.6 ± 26.5

60

73.9 ± 27.9,

77.2 ± 27.2mg/cc

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5

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가

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3, 4

5

가

가

5

3

4

,

40

33%,

50

31%

60

40%

가

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5

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3, 4

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5

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