

경피적 척추체 성형술 후 새로 발생한 인접 척추체 골절의 위험 인자

김명호·민상혁·전숙하

단국대학교 의과대학 정형외과학교실

목 적: 경피적 척추체 성형술 후 인접 척추체에서 새로운 골절이 발생하는 것과 관련된 인자들에 대해 알아보았다.

대상 및 방법: 1996년 1월부터 2005년 6월까지 본원에서 경피적 척추체 성형술을 시행 받고 1년 이상 추시가 가능했던 296명의 환자들 중 인접 척추체 골절이 발생한 환자 16명과 골절 없이 추시되고 있는 환자들 중 추출된 30명에 대해 각각 수술 전후의 골절 척추체의 높이 회복률 (%)과 후만각 (kyphotic angle) 회복 정도를 측정하였다.

결 과: 경피적 척추체 성형술 후 인접 척추체 골절이 발생한 16명의 평균 척추체 높이 회복률 및 후만각 회복정도는 평균 16.7%와 2.53도로 나타났으며, 대조군의 경우 각각 평균 7.07%와 4.2도로 나타났으며, 높이 회복률이 높을수록 ($p < 0.01$) 후만각 회복 정도가 적을수록 ($p < 0.05$) 인접부위 척추체 골절의 위험이 증가하였다. 특히 척추체 전방부보다 중심부의 높이 회복률이 클수록 인접 척추체의 골절 위험도가 증가하였고 통계적으로 유의하였다 (all $p < 0.05$, Logistic regression test SPSS 13.0).

결 론: 척추체 성형술시 수술 후 추체 높이 회복률이 클수록 인접척추체 골절의 위험이 증가할 것으로 사료된다.

색인 단어: 인접 추체 골절, 경피적 척추체 성형술

Risk Factors of New Compression Fractures in Adjacent Vertebrae after Percutaneous Vertebroplasty

Myung-Ho Kim, M.D., Sang-Hyuk Min, M.D., Suk-Ha Jeon, M.D.

Department of Orthopedic Surgery, Dankook University College of Medicine, Cheonan, Korea

Purpose: To evaluate the risk factors related to the development of new fractures in adjacent vertebrae after vertebroplasty.

Materials and Methods: The study was conducted on 46 patients in whom 296 patients were performed during last 9 years. We were especially concerned with the restoration rate of vertebral height and kyphotic angle and estimated them on simple X-ray films.

Results: In patients experienced subsequent vertebral fractures and no subsequent vertebral fractures after vertebroplasty, the mean height restoration rate of treated vertebra were 16.7% and 7.07%, and the kyphotic angle difference were 2.53 degree and 4.2 degree. The greater degree of height restoration of the vertebral body, especially in middle vertebral height and the lesser degree of kyphotic angle difference increased the risk of adjacent vertebral fracture risk. This results were available statistically (all $p < 0.05$, Logistic regression test, SPSS 13.0).

Conclusion: It may be thought that the vertebral body height restoration rate will become risk factor of adjacent vertebral fractures.

Key Words: Adjacent vertebral fractures, Vertebroplasty

서 론

(polymethylmethacrylate)

(%) (kyphotic angle)

(Table 1).

가

가

가

3,15)

가

(lower endplate)

(upper endplate)

(Fig. 1, 2).

2. 시술 및 술 후 처치

(back pain)

(MRI)

(bone scan)

(functional spine unit)

(%) (ky-

photic angle)

대상 및 방법

1. 연구 대상

1996 1 2005 6

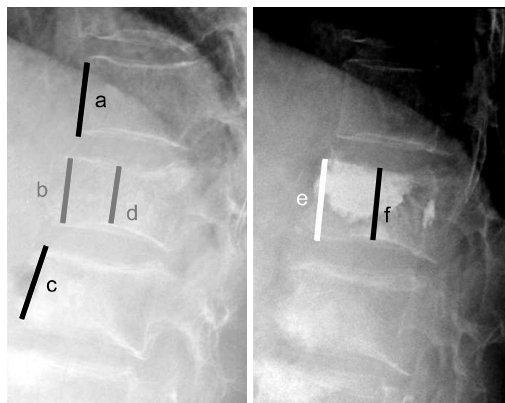
1 가 가 296

16

30

Table 1. The comparison between subsequent fractures group & no subsequent fractures group

	Adjacent fractures group	No adjacent fractures group
Age	66 (62~82)	70 (61~83)
Sex	M : F = 0 : 16	M : F = 4 : 26
Initial fracture level	Lumbar : 5 (37.5%) Thoracic : 10 (62.5%)	Lumbar : 13 (43.3%) Thoracic : 17 (56.7%)
BMD (T-score)	-3.16 (-2.12~-4.61)	-3.24 (-1.76~-4.91)
Spine	-2.72 (-2.17~-3.87)	-2.91 (-1.99~-4.09)
Femur		



- Vertebral body height before compression fracture (Y)

$$Y = \frac{(a+c)}{2}$$
- Anterior height restoration rate (A)

$$A = \frac{(e-b)}{Y} \times 100 (\%)$$
- Middle height restoration rate (M)

$$M = \frac{(f-d)}{Y} \times 100 (\%)$$

Fig. 1. The method of estimating in vertebral body height restoration rate.

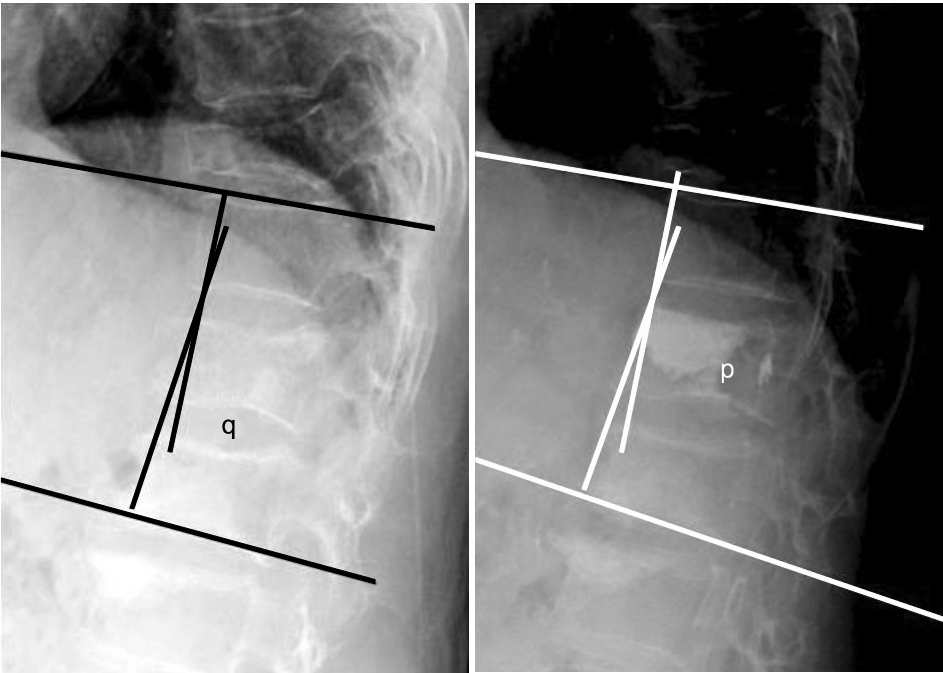


Fig. 2. The method of estimating in Kyphotic angle differences. Kyphotic angle difference = p-q.

가 2, 3, 6, 1, 3, 2

3. 평가 방법

(back pain)
가 3
,
가 , T2
(hot uptake)
(Table 2).
가 4
가

4. 통계학적 분석

Table 2. The distance from previous treated vertebra to adjacent new fracture

Distance from treated vertebra	No. of cases
1 vertebra	8
2 vertebrae	3
3 vertebrae	3
1 & 3 vertebrae	2
Total	16

(%) T-test

Pearson correlation analysis
(SPSS 13.0).

결 과

16
16.7%,
17.4% 2.53
7.07% 7.6%
4.2
(p<0.03,
p<0.01).

Table 3. The statistic analysis using Logistic regression test (SPSS13.0)

	B	S.E.	Wald	p-value	Exp (B)
Kyphotic angle difference	-.591	.249	5.648	.017	.554
A	.298	.107	7.772	.005	1.347
M	.322	.099	10.498	.001	1.379

($p < 0.01$, $p = 0.005$,
 $p = 0.001$), 가 가
0.017) 가

가 (Table 3, Wald ,
7.772, 10.498). 가
3.2 cc 3.8 cc
5.5 cc 5.1 cc

고찰

9 6

296 16

37 12.5%

가

14)

가

가

7,13)

10,12,15,16)

가

15)

3,6,7,9). Uppin 17)

2

5.4%

5,8)

Table 4. The statistic analysis using Pearson correlation analysis (SPSS 13.0)

		The Kyphotic angle difference	The restoration rate of anterior vertebral height
The Kyphotic angle difference	Pearson coefficient	1.000	0.773
	p-value	.	0.044
	n	46	46
The restoration rate of anterior vertebral height	Pearson coefficient	0.773	1.000
	p-value	0.044	.
	n	46	46

		The Kyphotic angle difference	The restoration rate of middle vertebral height
The Kyphotic angle difference	Pearson coefficient	1.000	0.245
	p-value	.	0.177
	n	46	46
The restoration rate of middle vertebral height	Pearson coefficient	0.245	1.000
	p-value	0.177	.
	n	46	46

가

가 (Table 3).

가

(SPSS

13.0, Pearson correlation analysis) (Table 4).

Liebschner ¹¹⁾

가

Baroud 1) ‘

(pillar effect)',

가

(endplate)

(bulging)

가

가가

가

가



Fig. 3. 72 year-old female visited in our hospital because of back pain after vertebroplasty of T12 Without trauma history. **(A)** Simple radiograph and **(B)** Magnetic Resonance Image after 6 months since T12 vertebroplasty in local clinic. The large amount of cement augmented in midportion of vertebral body.

가
가 가
가 가
Belkoff ²⁾ FSU
(functional spine unit)
가 (stiffness)
Liebschner ¹¹⁾
Polikeit ¹⁴⁾
(neucleus pulposus) 가
(deflication) (FSU) 가 가
가 가 ^{9,11)}
가 가
가 가
72 가 6 가
12 가
11 가
가 (Fig. 3). 20~25% ^{4,8,11)}

참 고 문 헌

- 1) **Baroud G, Nemes J, Ferguson SJ, Steffen T:** Material changes in osteoporotic human cancellous bone following infiltration with acrylic bone cement for a vertebral cement augmentation. *Comput Methods Biomech Biomed Engin*, **6**: 133-139, 2003.
- 2) **Belkoff SM, Mathis JM, Erbe EM, Fenton DC:** Biomechanical evaluation of a new bone cement for use in vertebroplasty. *Spine*, **25**: 1061-1064, 2000.
- 3) **Berlemann U, Ferguson SJ, Nolte LP, Heini PF:** Adjacent vertebral failure after vertebroplasty. A biomechanical investigation. *J Bone Joint Surg Br*, **84**: 748-752, 2002.
- 4) **Delmas PD, Ensrud KE, Adachi JD, et al:** Efficacy of

- raloxifene on vertebral fracture risk reduction in postmenopausal women with osteoporosis: four-year results from a randomized clinical trial. *J Clin Endocrinol Metab*, **87**: 3609-3617, 2002.
- 5) **Evans AJ, Jensen ME, Kip KE, et al**: Vertebral compression fractures: pain reduction and improvement in functional mobility after percutaneous polymethylmethacrylate vertebroplasty retrospective report of 245 cases. *Radiology*, **226**: 366-372, 2003.
- 6) **Ferguson SJ, Berlemann U, Heini PF, Nolte LP**: Evaluation of adjacent segment failure following vertebroplasty. *Orthopedic Research Society*, **280**: 362-637, 2001.
- 7) **Hwang JK, Kim JH, Kim JH**: Vertebroplasty in the treatment of osteoporotic compression fracture more than 1 year follow up. *J Korean Fracture Soc*, **17**: 368-373, 2004.
- 8) **Jensen ME, Dion JE**: Percutaneous vertebroplasty in the treatment of osteoporotic compression fractures. *Neuroimaging Clin N Am*, **10**: 547-568, 2000.
- 9) **Kim SH, Kang HS, Choi JA, Ahn JM**: Risk factors of new compression fractures in adjacent vertebrae after percutaneous vertebroplasty. *Acta Radiol*, **45**: 440-445, 2004.
- 10) **Kumpan W, Salomonowitz E, Seidl G, Wittich GR**: The intravertebral vacuum phenomenon. *Skeletal Radiol*, **15**: 444-447, 1986.
- 11) **Liebschner MA, Rosenberg WS, Keaveny TM**: Effects of bone cement volume and distribution on vertebral stiffness after vertebroplasty. *Spine*, **26**: 1547-1554, 2001.
- 12) **Lindsay R, Silverman SL, Cooper C, et al**: Risk of new vertebral fracture in the year following a fracture. *JAMA*, **285**: 320-323, 2001.
- 13) **Min SH, Kim MH, Park HG, Paik HD**: A clinical analysis of 260 percutaneous vertebroplasty in the treatment of osteoporotic compression fracture. *J Korean Fracture Soc*, **19**: 357-362, 2006.
- 14) **Polikeit A, Nolte AP, Ferguson SJ**: The effect of cement augmentation on load transfer in an osteoporotic functional spine unit. *Spine*, **28**: 991-996, 2003.
- 15) **Schlaich C, Minne HW, Bruckner T, et al**: Reduced pulmonary function in patients with spinal osteoporotic fractures. *Osteoporos Int*, **8**: 261-267, 1998.
- 16) **Silverman SL**: The clinical consequences of vertebral compression fracture. *Bone*, **13**(Suppl 2): S27-31, 1992.
- 17) **Uppin AA, Hirsch JA, Centenera LV, Pfiefer BA, Pazianos AG, Choi IS**: Occurrence of new vertebral body fracture after percutaneous vertebroplasty in patients with osteoporosis. *Radiology*, **226**: 119-124, 2003.