

1

2 2 3 3 3

1365  
63 Castellvi  
가 63  
MRI  
T1, T2  
63.5%(40 ), 36.5%(23 )  
41.3%( 7 , 19 ) 가 , 3 30.2%(  
8 , 11 ), 2 23.8%( 8 , 7 ), , 4  
4.8%( 0 , 3 )  
66.7%( 15 , 27 )  
가 , 가 28.6%( 11 , 7 ),  
27.0%( 9 , 8 ), 9.5%( 2 , 4 )  
47.8% 17.5%  
(p=0.02), 39.1% 20.0%  
(p=0.18). 65.2%,  
8.7% 67.5%, 10.0% 가  
가

level  
1955 Stinchfield  
가 4 - 8% (9) 31  
(1 - 2). 30  
1917 , 1989 Elster (1) 1997  
Bertolotti가 Vergauwen (10)  
1 (3, 4). 1974 ,  
Nachemson (5) , 1997 Bonaiuti (6), 가 1990  
1997 Van Tulder (7) 가 (2)  
, 1981 Wigh (8) 2 3 가  
200

1 가 , (magnetic resonance imaging.  
2 MRI )  
3

MRI

47

MRI

1.5T MR Signa(GE Medical system, Milwaukee, Wisconsin, U.S.A.) Magnetom Vision (Siemens AG, Erlangen, Germany)

T1, T2

1995 1998

MRI

1365

71

8

63

44 19 38.7 (17 - 69 )

63

36

27

46.8

(15 - 72 )

MRI

16

MRI

MRI

(3).

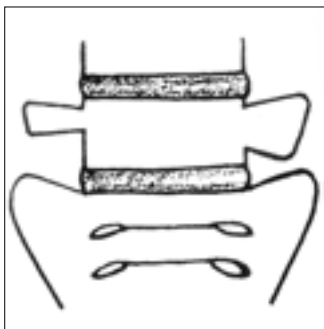
가

Castellvi

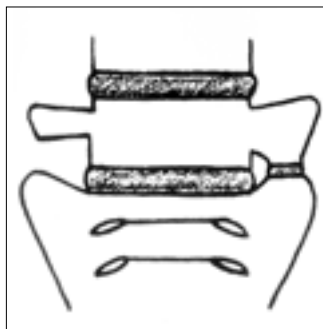
(type A)

(type

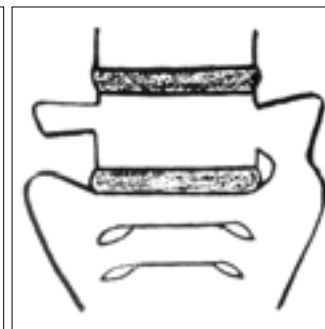
### Unilateral group



A

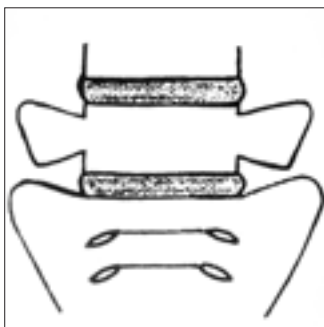


C

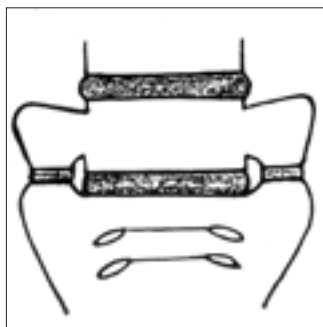


E

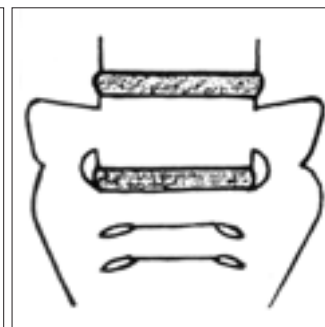
### Bilateral group



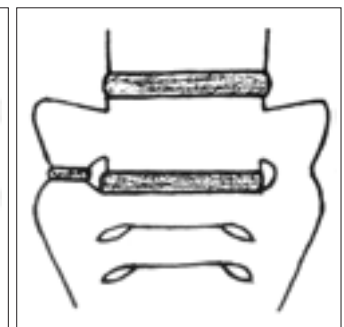
B



D



F



G

**Fig. 1.** Classification of lumbosacral transitional vertebrae according to Castellvi 's criteria.

**A.** Type A shows unilateral dysplastic transverse process with triangular shape measuring at least 19 mm in height.

**B.** Type B shows bilaterality.

**C.** Type C shows incomplete lumbarization/sacralization: there is a diarthrodial joint between enlarged transverse process and the sacral ala.

**D.** Type D shows bilaterality.

**E.** Type E shows complete lumbarization/sacralization: there is a true bony union between enlarged transverse process and the sacral ala.

**F.** Type F shows bilaterality.

**G.** Type G shows type A on one side and type A on the other.

1365 71 가  
5.2% .  
63  
63.5%(40 ) 36.5%(23 )  
, 1 41.3%(26 ) 가  
, 11.1%(7 ), 30.2%(19 )  
(Table 1).

**D.** T2-weighted MR axial image demonstrates diffuse bulging disc at L4-5 level with concentric annular tear (black arrows), and asymmetrical facet joint osteoarthritic changes with more prominent change on the left side (white arrow).

D

66.7%(42 ) 34.9%(22 ) 가 ,  
(p=0.004). ,  
가 (p>0.05) (Table 2).  
65.2%(15 ) 67.5%(27 )  
(p=0.93) (Table 3).  
47.8%(11 ) 17.5%(7 )  
(p=0.02) (Table 4).  
39.1%(9 ) 20.0%(8 )  
(p=0.18) (Table 5).  
8.7%(2 ) 10.0%(4 )  
가 (p=0.78) (Table 6).

**Table 1.** Incidence of the Lumbosacral Transitional Vertebrae according to Classification of Castellvi

	Unilateral	Bilateral	Total
Type 1	7 (11.1%)	19 (30.2%)	26 (41.3%)
Type 2	8 (12.7%)	7 (11.1%)	15 (23.8%)
Type 3	8 (12.7%)	11 (17.5%)	19 (30.2%)
Type 4	0 (0.0%)	3 (4.8%)	3 (4.8%)
Total	23 (36.5%)	40 (63.5%)	63 (100%)

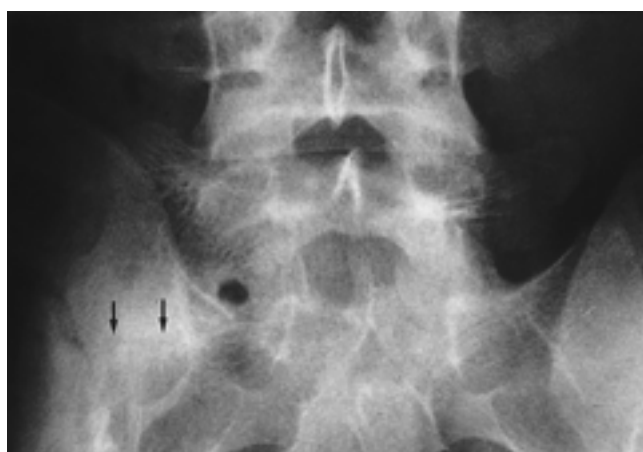
**Table 2.** Comparison of the Incidence of Combined Findings in Non-LSTV\* Control Group with LSTV<sup>†</sup> Group

	Non-LSTV (N = 63)	LSTV (N = 63)
Disc Herniations	22 (34.9%)	42 (66.7%)
Facet Joint OA <sup>‡</sup> Change	11 (17.4%)	19 (30.2%)
Scoliosis	14 (22.2%)	18 (28.6%)
Spondylolisthesis	5 (7.9%)	6 (9.5%)

\*Non-LSTV : normal control group without lumbosacral transitional vertebrae

<sup>†</sup>LSTV : lumbosacral transitional vertebrae

<sup>‡</sup>OA : osteoarthritic



**A**

**Fig. 3.** A 21-year-old male with type A (unilateral) lumbosacral transitional vertebrae.

**A.** Plain A-P radiography shows complete bony union between enlarged transverse process of L5 vertebra and the sacral ala on the right side (arrows).

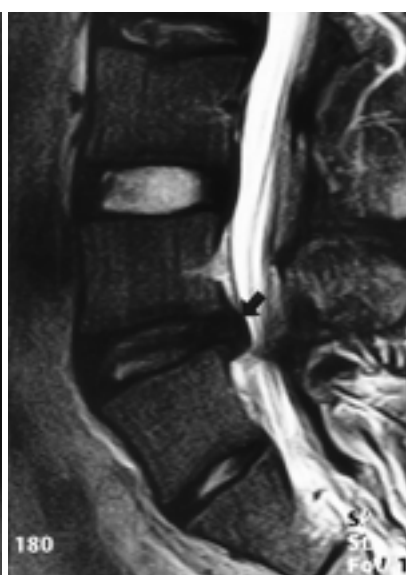
**B.** Plain A-P radiography shows complete bony union (arrows), and, mild degree scoliosis with right convexity.

**C.** T2-weighted MR sagittal image demonstrates degeneration of the L4-5 disc just above the lumbosacral transitional vertebra (arrow).

**D.** T2-weighted MR axial image demonstrates mild degree protruded disc (small arrow), and asymmetrical facet joint osteoarthritic change with more prominent change on the left side (large arrow).



**B**



**C**



**D**

**Table 3.** Comparison of the Incidence of Disc Herniations between Unilateral and Bilateral Groups

	Unilateral (n = 23)	Bilateral (n = 40)	Total (N = 63)
Type	4 (17.4%)	13 (32.5%)	17 (27.0%)
Type	4 (17.4%)	3 (7.5%)	7 (11.1%)
Type	7 (30.4%)	9 (22.5%)	16 (25.4%)
Type	0 (0.0%)	2 (5.0%)	2 (3.2%)
Total	15 (65.2%)	27 (67.5%)	42 (66.7%)

**Table 4.** Comparison of the Incidence of Facet Joint Osteoarthritic Change between Unilateral and Bilateral Groups

	Unilateral (n = 23)	Bilateral (n = 40)	Total (N = 63)
Type	3 (13.0%)	3 (7.5%)	6 (9.5%)
Type	3 (13.0%)	2 (5.0%)	5 (7.9%)
Type	5 (21.7%)	1 (2.5%)	6 (9.5%)
Type	0 (0.0%)	1 (2.5%)	1 (1.6%)
Total	11 (47.8%)	7 (17.5%)	18 (28.6%)

**Table 5.** Comparison of the Incidence of Scoliosis between Unilateral and Bilateral Groups

	Unilateral (n = 23)	Bilateral (n = 40)	Total (N = 63)
Type	3 (13.0%)	5 (12.5%)	8 (12.7%)
Type	2 (8.7%)	1 (2.5%)	3 (4.8%)
Type	4 (17.4%)	1 (2.5%)	5 (7.9%)
Type	0 (0.0%)	1 (2.5%)	1 (1.6%)
Total	9 (39.1%)	8 (20.0%)	17 (27.0%)

**Table 6.** Comparison of the Incidence of Spondylolisthesis between Unilateral and Bilateral Groups

	Unilateral (n = 23)	Bilateral (n = 40)	Total (N = 63)
Type	1 (4.3%)	2 (5.0%)	3 (4.8%)
Type	0 (0.0%)	1 (2.5%)	1 (1.6%)
Type	1 (4.3%)	1 (2.5%)	2 (3.2%)
Type	0 (0.0%)	0 (0.0%)	0 (0.0%)
Total	2 (8.7%)	4 (10.0%)	6 (9.5%)

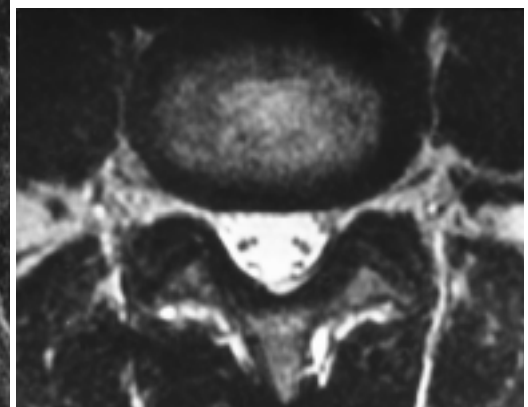
**A****Fig. 4.** A 21 year-old male with type B (bilateral) lumbosacral transitional vertebrae.

**A.** Plain A-P radiography shows diarthrodial joints between enlarged transverse process of L5 vertebra and the sacral ala on both side (arrows).

**B.** Plain A-P radiography shows diarthrodial joints (arrows), and no evidence of scoliosis.

**C.** T2-weighted MR sagittal image demonstrates no evidence of disc herniation.

**D.** T2-weighted MR axial image demonstrates normal disc and facet joints at L4-5 level.

**B****C****D**



A

**Fig. 5.** A 35-year-old male with type B (bilateral) lumbosacral transitional vertebrae.

**A.** Plain A-P radiography shows complete bony union between enlarged transverse process of L5 vertebra and the sacral ala on both side (arrows).

**B.** Plain A-P radiography shows complete bony union (arrows), and no evidence of scoliosis.

**C.** T2-weighted MR sagittal image demonstrates no evidence of disc herniation.

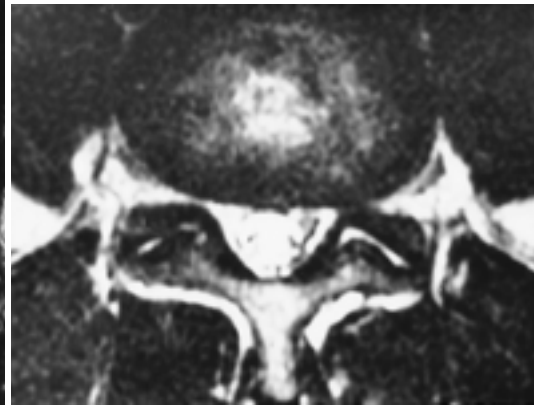
**D.** T2-weighted MR axial image demonstrates normal disc and facet joints at L4-5 level.



B



C



D

, Avrahami

(2, 4). (13) 120  
(hemisacralization)

(torque moment) 가  
(2, 9).

(5) 5.0% Elster (1) 5.2% Tini , Castellvi (3) Vergauwen (10) 2  
가 4 가 Castellvi (4) 가  
(3) , 3 2  
가 가 , 2, 3  
1 가  
가 (4, 11). 20.0%  
39.1%  
. Avrahami (13)

52% 가 ,  
 39.1% 가 .  
 6 가 , 3  
 (convex side) (concave side)  
 Castellvi (3) 60  
 63 6  
 (9.5%)  
 가 MRI  
 가 MRI  
 MRI  
 MRI  
 가  
 가  
 가

1. Elster AD. Bertolotti 's syndrome revisited:transitional vertebrae of the lumbar spine. *Spine* 1989;14:1373-1377
2. . . . . 1990;26:1244-1248
3. Castellvi AE, Goldstein LA, Chan DK. Lumbo-sacral transitional vertebrae and their relationship with lumbar extradural defects. *Spine* 1984;9:493-495
4. Tini PG, Wiser C, Zinn WM. The transitional vertebrae of the lumbosacral spine:its radiological classification, incidence, prevalence and clinical significance. *Rheumatol Rehabil* 1977;16:180-185
5. Nachemson ALF. Towards a better understanding of low back pain:a review of the mechanics of the lumbar disc. *Rheumatol Rehabil* 1975;14:129-140
6. Bonaiuti D, Faccenda I, Flores A. Sacralization of the 5th lumbar vertebra and backache:what 's the possible relationship? *Med Lav* 1997;88:226-236
7. Van Tulder MW, Assendelft WJ, Koes BW, Bouter LM. Spinal radiographic findings and nonspecific low back pain:a systematic review of observational studies. *Spine* 1997;22:427-434
8. Wigh RE, Anthony HF. Transitional lumbosacral discs:probability of herniation. *Spine* 1981;6:168-171
9. Stinchfield FE, Sinton WA. Clinical significance of the transitional lumbosacral vertebrae:relationship to back pain, disc disease and sciatica. *JAMA* 1955;157:1107-1109
10. Vergauwen S, Rarizel PM, Van Breusegem L. et al. Distribution and incidence of degenerative spine changes in patients with a lumbo-sacral transitional vertebra. *Eur Spine J* 1997;6:168-172
11. Southworth JD, Bersack SR. Anomalies of the lumbosacral vertebrae in 550 individuals without symptoms referable to the low back. *AJR Am J Roentgenol* 1950;64:624-634
12. Resnick D, Niwayama G. Anatomy of individual joints. In Resnick D. *Diagnosis of bone and joint disorders*. 3rd ed. Philadelphia:W. B. Saunders 1995:672-768
13. Avrahami E, Cohn DF, Yaron M. Computerized tomography, clinical and X-ray correlation in the hemisacralized fifth lumbar vertebra. *Clin Rheumatol* 1986;5:332-337
14. Guebert GM, Yochum TR, Rowe LJ. Congenital anomalies and normal skeletal variants. In Yochum TR, Rowe LJ. *Essentials of skeletal radiology*. 2nd ed. Baltimore:Williams & Wilkins 1996:197-306

## Unilateral and Bilateral Lumbosacral Transitional Vertebrae : Comparison of the Incidence of Combined Diseases<sup>1</sup>

Jin Yong Park, M.D., Soon Tae Kwon, M.D., Tae Il Han, M.D.<sup>2</sup>, Se Hyo Lee, M.D., Ki Tae Han, M.D.,  
Hyun Jeong Kim, M.D.<sup>2</sup>, Jae Sung An, M.D.<sup>3</sup>, Jun Young Yang, M.D.<sup>3</sup>, Jun Kyu Lee, M.D.<sup>3</sup>

<sup>1</sup>Department of Diagnostic Radiology, Chungnam National University College of Medicine

<sup>2</sup>Department of Diagnostic Radiology, Eulji College of Medicine

<sup>3</sup>Department of Orthopedic Surgery, Chungnam National University College of Medicine

**Purpose:** The purpose of this study was to evaluate the radiologic findings of lumbosacral transitional vertebrae (LSTV), as seen on plain radiographs and MRI, and to compare the incidence of combined diseases between unilateral and bilateral groups.

**Materials and Methods:** We retrospectively evaluated the plain radiographs and MR images of 63 patients with LSTV, classifying its type according to Castellvi's criteria, and evaluated disc herniations, facet joint osteoarthritic change, scoliosis, and spondylolisthesis. We then compared the incidence of each combined diseases between unilateral and bilateral groups, and as a control group, 63 patients without LSTV were also evaluated.

**Results:** Forty of 63 cases of LSTV (63.5%) were bilateral, and 23 (36.5%) unilateral. According to Castellvi's criteria, the incidence of type I was 41.3% (unilateral 7 cases, bilateral 19), type II 30.2% (unilateral 8 cases, bilateral 11), type III 23.8% (unilateral 8 cases, bilateral 7), and type IV 4.8% (unilateral 0 cases, bilateral 3). With combined diseases, the incidence of disc herniation was 66.7% (unilateral 15 cases, bilateral 27), moderate to severe facet joint osteoarthritic change 28.6% (unilateral 11 cases, bilateral 7), scoliosis 27.0% (unilateral 9 cases, bilateral 8), and spondylolisthesis 9.5% (unilateral 2 cases, bilateral 4). The incidence of facet joint osteoarthritic change was significantly higher in the unilateral group (47.8%) than in the bilateral group (17.5%) ( $p=0.02$ ), and scoliosis occurred at a higher rate in the unilateral group (39.1%) than in the bilateral group (20.0%) ( $p=0.18$ ). There was, however, no significant difference in the incidence of disc herniation and spondylolisthesis between the two groups (unilateral group: 65.2% and 8.7%; bilateral group: 67.5% and 10.0%, respectively).

**Conclusion:** With LSTV, the incidence of facet joint osteoarthritic change was significantly higher in the unilateral group than in the bilateral group, and scoliosis also showed a higher rate of occurrence in the unilateral group.

**Index words :** Spine, abnormalities  
Spine, radiography  
Spine, MR

Address reprint requests to : Soon Tae Kwon, M.D., Department of Diagnostic Radiology, Chungnam National University Hospital.  
640, Daesa-Dong, Jung-Gu, Taejeon 301-040, Korea.  
Tel. 82-42-220-7333, Fax. 82-42-253-0061