Journal of Experimental and Clinical Medicine
https://dergipark.org.tr/omujecm

Research Article

J Exp Clin Med
2023; 40(1): 62-65
doi: 10.52142/omujecm.40.1.13

Lumbosacral transitional vertebrae: An overlooked cause of back pain on MRI

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Received: 12.09.2022 • **Accepted/Published Online:** 26.11.2022 • **Final Version:** 18.03.2023

Abstract

To evaluate the frequency of lumbosacral transitional vertebrae (LSTV) on MRI in patients with backpain and clinically suspected of sacroiliitis. Sacroiliac MRI of patients who had backpain and were clinically suspicious for sacroiliitis between November 2021-March 2022 were retrospectively analyzed from the hospital database by two different radiologists. LSTV cases were identified and subgrouped according to Castellvi classification. Presence of sacroiliitis, degeneration and /or herniation of cranial segment intervertebral disc, facet joint hypertrophy, coxarthrosis and psoas atrophy were recorded. In cases where radiologists were in conflict, consensus was made. Between November 2021-March 2022, 614 sacroiliac MRIs were obtained and 81 (13%) had LSTV. Fifty-nine patients were female (72.8%). Mean age was 43.4. The most common identified LSTV was type 1a (n=30, 10 right-sided, 20 left-sided). Sacroiliitis was significantly more common in younger patients (p=0.04) and in males (p=0.009). Disc degeneration, disc herniation, facet joint hypertrophy and psoas atrophy increased significantly with age (p=0.007, p=0.001, p=0.002 and p=0.013 respectively). No correlation was found between gender or presence of sacroiliitis and any type of LSTV. LSTV may present with backpain and should be considered in patients where sacroiliitis is clinically suspected. MRI is a useful tool to identify other accompanying pathologies in these cases.

Keywords: back pain; sacroiliitis; lumbosacral transitional vertebra; disc degeneration; spine transitional anomalies

1. Introduction

Lumbosacral transitional vertebra (LSTV) is a common congenital anatomical variant and its prevalence varies 7 to 32% in the literature (1-4). In these cases, the transverse process of the last lumbar vertebrae is somewhat elongated and forms a connection with sacrum which may manifest on a wide spectrum from an isolated elongated transverse process to complete fusion with the sacrum. According to its relation with the sacrum, LSTV can be classified in to four types by the Castellvi classification (1). Type 1 indicates an enlarged transvers process (>19 mm) of L5. Type 2 refers to pseudo-articulation of the enlarged transvers process with sacral ala whereas Type 3 involves complete fusion of the transverse process and the ala. Type 4 are those with Type 2 on one side and Type 3 on the other side. Moreover, “a” is added for unilateral involvement and “b” is added for bilateral involvement in this classification. Additionally in 1996, O’Driscoll et al proposed another classification based on the S1 lumbarization and S1-S2 intervertebral disc morphology (5).

Lumbosacral transitional vertebrae-related back pain was first introduced in 1917 by Bertolotti(6) who attributed the pain to the arthritis at the pseudo-articulation. In these patients the pain and the limited range of motion becomes more prominent with ipsilateral bending and rotation. It’s been shown in the literature that LSTV is a protective factor for disc degeneration at the level of transition, whereas it causes increased load at the cephalad disc, making it vulnerable for degeneration (7-9). Early and more advanced disc degeneration has been reported in LSTV, particularly in young patients (2, 7, 10). Additionally, LSTV prevalence was found to be higher in patients with lumbar disc herniation compared to control group (11).

In this study we aimed to evaluate the presence of LSTV in patients who underwent MRI with a pre-diagnosis of sacroiliitis.

2. Materials and Methods

2.1. Patient selection

Sacroiliac MRIs that were obtained with a sacroiliitis pre-diagnosis between November 2021-March 2022 were retrospectively analyzed from the hospital picture archiving and communication system (PACS). The study protocol was approved by the Kayseri State Hospital Ethics Committee (21.02.2023/803). Patients with major surgery or fracture history of lumbar, hip or pelvic area were excluded. Images were evaluated by two radiologists. Patients with LSTV were recorded and grouped according to Castellvi classification.

2.2. Magnetic resonance imaging and radiological analysis

Sacroiliac MRI was performed by a 1,5 T MRI system (Magnetom Aera, Siemens, Erlangen). The MRI protocol

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included a coronal T1-weighted and T2-weighted fast spin-echo (FSE) sequence, a coronal short-tau inversion recovery sequence, and an axial T2-weighted fat-saturated FSE sequences. Intervertebral discs cephalad and at the level of transitional level were evaluated using the Pfirrmann and Modic classifications (12, 13). Presence of sacroiliitis, herniation of intervertebral discs, facet joint hypertrophy, coxarthrosis and psoas atrophy were recorded. In cases where radiologists were in conflict, consensus was made.

2.3. Statistical analysis

SPSS 22 statistical package program was used for statistical analysis. Study characteristics are stated as means, frequencies or ratios.

3. Results

Of 614 sacroiliac MRIs, 81 (13%) had LSTV. Fifty-nine patients were female (72.8%). Mean age was 43.4. Thirty patients had Type 1a (10 right-sided, 20 left-sided); 13 patients had Type 1b (Fig.1); 27 patients had Type 2a (10 right-sided, 17 left-sided) (Fig. 2); 17 patients had Type 2b; 5 patients had Type 3a (4 right-sided, 1 left sided) (Fig. 3), 1 patient had Type 3b and 3 patients had Type 4.

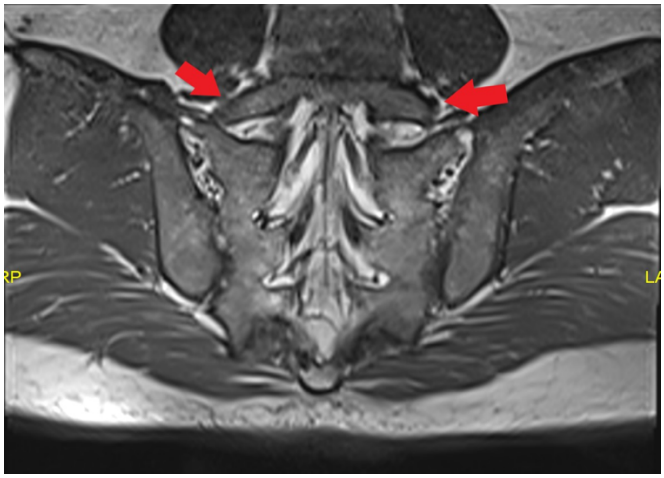

Fig. 1. Coronal T2- weighted MRI image shows bilateral enlarged transverse processes (Type 1b)

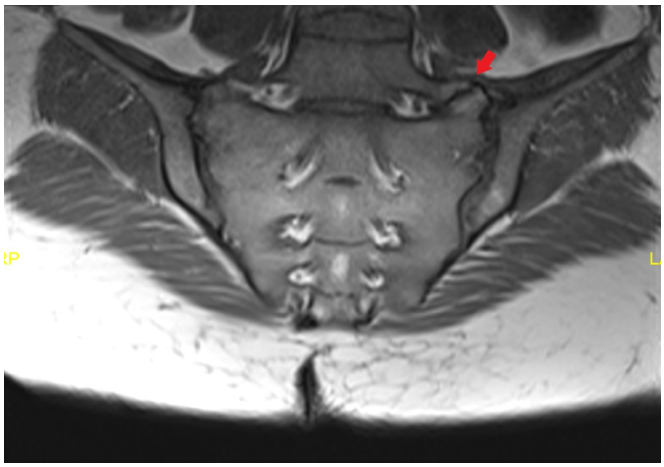

Fig. 2. Pseudo-articulation of left transvers process of L5 and sacral ala is seen on coronal T2- weighted image (Type 2a). Increased intensity is noted adjacent to the pseudo-articulation, suggesting inflammation

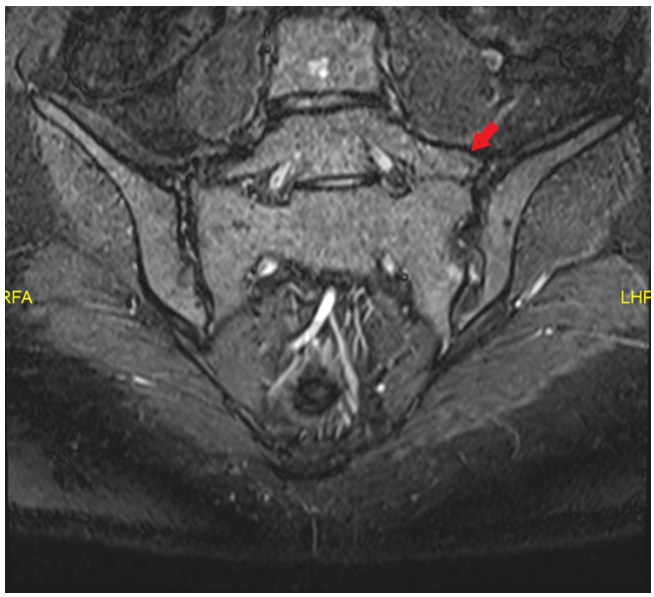

Fig. 3. Left transvers process of L5 is totally fused with sacrum on this coronal STIR image (Type 3a)

Concomitant sacroiliitis was present in 11 cases (13.5%), in 10 cases sacroiliitis was bilateral and in one case only right side was involved. Degeneration was noted in the cephalad intervertebral disc in 42 patients (52%), accompanied by disc herniation in 27 patients (33.3%). Disc was spared at the level of transition 40 of the 42 cases with cephalad disc degeneration. Facet joint hypertrophy was present in 11 patients (13.6%), coxarthrosis in two patients and psoas atrophy in 3 patients.

Sacroiliitis was significantly more frequent in younger ($p=0.04$) and in male patients ($p=0.009$). Presence of sacroiliitis was not significantly correlated with any LSTV types. Rates of disc degeneration, disc herniation, facet joint hypertrophy and psoas atrophy increased significantly with age ($p=0.007$, $p=0.001$, $p=0.002$ and $p=0.13$, respectively). LSTV type was also not correlated with gender or disco-vertebral pathologies.

4. Discussion

Lumbosacral transition is a relatively common pathology but mostly overlooked in the management of back pain. Even though x-ray is the first line for imaging in the evaluation of back pain, MRI has become increasingly more available particularly for identifying active inflammation in the sacroiliac joints and detailed visualization of disc pathologies. Reported LSTV prevalence varies among the imaging modalities used. Standard AP x-rays have 76-84% accuracy for diagnosis and 53-58% accuracy for classification of LSTV (14). Previous reports prevail a prevalence 7 to 32% with male dominance (%28.1 vs %11.1) (1-4). However, in our study, 13 percent of our patients had LSTV and majority of the cases were female. We attribute this difference to our small sample size, that our study only includes the symptomatic patients, and the more common hospital visits by the female.

Cadaveric studies indicated that SI joint width was

correlated with sacral height and sacrum AP dimension; and suggested that LSTV development may be related to load bearing capacity of normal sacrum at very early periods. When the sacrum is shorter, the SI joint surface also is smaller resulting in insufficient transfer of load to pelvis. Therefore, in these patients with small sacra with a narrow SI joint surface, sacrum may fuse with L5 to increase its load bearing capacity (15). The discrepancy of load bearing is more prominent in one-sided cases (8).

Due to the disruption of the pelvic alignment and scoliosis, degenerative changes at the intervertebral disc and the facet joint cephalad to the transition level may be seen (16). Presence of LSTV has been shown to have a protective effect on the intervertebral disc at the level of transition (7, 9, 16, 17). An increase in this protective effect was noted as the osseous bridge is more prominent (9). When compared with control group, degenerative changes were more severe and developed at a younger age (2, 7, 10). In our study disc degeneration was noted in half of the patients, and of these cases only three showed degeneration at the level of the transition. These three patients were older patients with accompanying other degenerative changes in lumber spine and hip. Other than those, disc at the level of transition was spared. Our results showed an increase of degenerative changes with age, which was expected.

In their study of 211 cases, Apazidis et al reported that Type 1a was the most common subtype, with a prevalence of 14.7% (18). However, Type 1a mostly has no clinical significance and requires no further evaluation (1). In another study prevalence of Type 1 and 2 was reported as 40% each, Type 3 was 11,5% and Type 4 was 5,25% (19). In our study Type 1 and 2 consisted of 53% and 54% of patients respectively. Type 3 was 7.5% and Type 4 was 3.7%.

Knowledge of LSTV presence has also utmost importance before surgery. In sacralized patients, pars interarticularis height and laminae width decreases, resulting in predisposition for spondylolysis and spondylolisthesis.

Pain related to LSTV still remains a controversial issue. Following the report of Bertolotti on LSTV-related back pain, some studies argued that degenerative changes at the pseudo-articulation was not related with the pain (20). On the other hand, scintigraphic activity was shown at the pseudo-articulation in symptomatic patients with no pathologies other than LSTV (21). Nerve compression by the osteophytes at the level of pseudo-articulation has been described (22). There are also case reports on compression of lumbar nerve between L5 transverse process and sacral ala, and extraforaminal nerve compression caudal to transition (23-25). In the literature, Bertolotti syndrome was found to be 4-8% in patients with back pain (4). Nardo noted that pain was more frequent in type 2 and 4 (19).

In conclusion, LSTV may manifest with backpain and should be kept in mind while evaluating MRI for back pain. MRI also enables identification other pathologies that may accompany this anatomical variant.

Ethical statement

The study protocol was approved by the Kayseri State Hospital Ethics Committee (21.02.2023/803).

Conflict of interest

The authors declared no conflict of interest.

Funding

No funding was used for the study.

Acknowledgments

None to declare.

Authors' contributions

Concept: G.T., A.E.A., A.K., Design: G.T., A.E.A., A.K., Data Collection or Processing: G.T., M.B., A.K., Analysis or Interpretation: G.T., M.B., A.K., Literature Search: G.T., A.E.A., Writing: G.T., A.K.

References

1. Castellvi AE, Goldstein LA, Chan DP. Lumbosacral transitional vertebrae and their relationship with lumbar extradural defects. Spine (Phila Pa 1976) 1984; 9(5): 493-495.

2. Otani K, Konno S, Kikuchi S. Lumbosacral transitional vertebrae and nerve-root symptoms. J Bone Joint Surg Br 2001; 83(8): 1137-1140.

3. Delport EG, Cocuzzella TR, Kim N, Marley J, Pruitt C, Delport AG. Lumbosacral transitional vertebrae: incidence in a consecutive patient series. Pain Physician 2006; 9(1): 53-56.

4. Sekharappa V, Amritanand R, Krishnan V, David KS. Lumbosacral transition vertebra: prevalence and its significance. Asian Spine J. 2014; 8(1): 51-58.

5. O'Driscoll CM, Irwin A, Saifuddin A. Variations in morphology of the lumbosacral junction on sagittal MRI: correlation with plain radiography. Skeletal Radiol. 1996; 25(3): 225-230.

6. Bertolotti M. Contributo alla conoscenza dei vizi di differenziazione regionale del rachide con speciale riguardo all assimilazione sacrale della v. lombare. Radiol Medica 1917; 4: 113-144.

7. Luoma K, Vehmas T, Raininko R, Luukkonen R, Riihimaki H. Lumbosacral transitional vertebra: relation to disc degeneration and low back pain. Spine (Phila Pa 1976) 2004; 29(2): 200-205.

8. Mahato NK. Lumbosacral transitional vertebrae: variations in low back structure, biomechanics, and stress patterns. J Chiropr Med 2012; 11(2): 134-135.

9. Farshad-Amacker NA, Herzog RJ, Hughes AP, Aichmair A, Farshad M. Associations between lumbosacral transitional anatomy types and degeneration at the transitional and adjacent segments. Spine J. 2015; 15(6): 1210-1216.

10. Quinlan JF, Duke D, Eustace S. Bertolotti's syndrome. A cause of back pain in young people. J Bone Joint Surg Br. 2006; 88(9): 1183-1186.

11. Avimadje M, Goupille P, Jeannou J, Gouthiere C, Valat JP. Can an anomalous lumbo-sacral or lumbo-iliac articulation cause low back pain? A retrospective study of 12 cases. Rev Rhum Engl Ed. 1999; 66(1): 35-39.

12. Pfirrmann CW, Metzdorf A, Zanetti M, Hodler J, Boos N.

Magnetic resonance classification of lumbar intervertebral disc degeneration. Spine (Phila Pa 1976). 2001; 26(17): 1873-1878.

13. Modic MT, Steinberg PM, Ross JS, Masaryk TJ, Carter JR. Degenerative disk disease: assessment of changes in vertebral body marrow with MR imaging. Radiology. 1988; 166(1 Pt 1): 193-199.

14. Jancuska JM, Spivak JM, Bendo J. A review of symptomatic lumbosacral transitional vertebrae: Bertolotti's syndrome. Int J Spine Surg. 2015; 9: 42.

15. Mahato NK. Morphological traits in sacra associated with complete and partial lumbarization of first sacral segment. Spine J. 2010; 10(10): 910-915.

16. McGrath K, Schmidt E, Rabah N, Abubakr M, Steinmetz M. Clinical assessment and management of Bertolotti Syndrome: a review of the literature. Spine J. 2021; 21(8): 1286-1296.

17. Vergauwen S, Parizel PM, van Breusegem L, van Goethem JW, Nackaerts Y, van den Hauwe L et al. Distribution and incidence of degenerative spine changes in patients with a lumbo-sacral transitional vertebra. Eur Spine J. 1997; 6(3): 168-172.

18. Apazidis A, Ricard PA, Diefenbach CM, Spivak JM. The prevalence of transitional vertebrae in the lumbar spine. Spine J. 2011; 11(9): 858-862.

19. Nardo L, Alizai H, Virayavanich W, Liu F, Hernandez A, Lynch JA et al. Lumbosacral transitional vertebrae: association with low back pain. Radiology. 2012; 265(2): 497-503.

20. Elster AD. Bertolotti's syndrome revisited. Transitional vertebrae of the lumbar spine. Spine (Phila Pa 1976). 1989; 14(12): 1373-1377.

21. Connolly LP, d'Hemecourt PA, Connoly SA, Drubach LA, Micheli LJ, Treves ST. Skeletal scintigraphy of young patients with low-back pain and a lumbosacral transitional vertebra. J Nucl Med. 2003; 44(6): 909-914.

22. Porter NA, Lalam RK, Tins BJ, Tyrrell PNM, Singh J, Cassar-Pullicino VN. Prevalence of extraforaminal nerve root compression below lumbosacral transitional vertebrae. Skeletal Radiol. 2014; 43(1): 55-60.

23. Weber J, Ernestus RI. Transitional lumbosacral segment with unilateral transverse process anomaly (Castellvi type 2A) resulting in extraforaminal impingement of the spinal nerve: a pathoanatomical study of four specimens and report of two clinical cases. Neurosurg Rev. 2010; 34(2): 143-150.

24. Abe E, Sato K, Shimada Y, Okada K, Yan K, Mizutani Y. Anterior decompression of foraminal stenosis below a lumbosacral transitional vertebra. A case report. Spine (Phila Pa 1976). 1997; 22(7): 823-826.

25. Ichihara K, Taguchi T, Hashida T, Ochi Y, Murakami T, Kawai S. The treatment of far-out foraminal stenosis below a lumbosacral transitional vertebra: a report of two cases. J Spinal Disord Tech. 2004; 17(2): 154-157.