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"Acquired" type Castellvi-IIIa lumbarization transformed from Castellvi-IIa following discectomy and fusion at lumbosacral level, a case report

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Abstract

Study Design. A retrospective case report.

Objective. To report a case that transformed from type Castellvi-IIa sacralization to type Castellvi-IIIa following decompression and fusion surgery at transitional disc (TD).

Summary of Background Data. Traditionally, lumbosacral transitional vertebra (LSTV) has been regarded as a congenital anomaly. No literature has ever reported that transformation from one type LSTV to another would happen after birth.

Methods. A 60-year-old man presented to our department with the complaint of low back pain and left sciatic pain, and was diagnosed of lumbar disc herniation at L4-5 and L5S1 levels. Lumbar digital radiography revealed an anomalous articulation formed between sacrum and enlarged right L5 transverse process, exhibiting a typical Castellvi-IIa sacralization. Dynamic lateral radiographs showed mobilization existed at L5S1 disc which was TD. The patient received posterior lumbar interbody fusion (PLIF) surgery at L4-5 and L5S1 levels. Postoperative CT examinations were taken to identify the progress of solid fusion at the operated segments.

Results. After surgery, the patient's symptoms alleviated obviously. As solid fusion developed at intended interbody regions with time, we found that bony bridge passed through the patient's anomalous articulation region gradually, and finally, complete osseous fusion of the right L_5 transverse process to the sacrum developed one year after surgery.

Conclusion. Following PLIF surgery at TD segment on a Castellvi-IIa Sacralization case, "acquired" transformation to Castellvi-IIIa might develop.

Key Words: lumbosacral transitional vertebra; Castellvi classification; acquired type transformation; transitional disc herniation; fusion

Level of Evidence: 5

Introduction

Lumbosacral transitional vertebra (LSTV) is defined as either lumbarization of the highest sacral spinal segment or sacralization of the most inferior lumbar spinal segment.[1-2] It is generally regarded as a congenital anomaly,[3-4] and no transformation from one LSTV type to another has been reported previously. Here we present one case which transformed into Castellvi-IIIa sacralization from Castellvi-IIa sacralization at ipsilateral side, following posterior lumbar interbody fusion surgery.

Case report

A 60-year-old man presented to our department with the complaint of low back pain and left sciatic pain on September 26, 2016, and was diagnosed of lumbar disc herniation at L4-5 and L5S1 levels. Lumbar digital radiography revealed an anomalous articulation formed between sacrum and enlarged right L5 transverse process, exhibiting a typical Castellvi-IIa sacralization. Dynamic lateral radiographs showed mobilization existed at L_5S_1 disc (transitional disc, TD) (Fig 1A-C).[5]

Lumbar CT scanning confirmed central disc herniation at L_{4-5} level and left lateral herniation at TD level (L_5S_1 disc). Anomalous articulation formation between sacrum and hypertrophic right L_5 transverse process was also detected (Fig. 2AB).

The patient received posterior lumbar interbody fusion (PLIF) surgery at L4-5 and L5S1 levels on September 28, 2016. During the operation, a 15 cm vertical incision was made centered over L5 process. The soft tissues were gently retracted to expose the spinous process, the lamina, and the facet joints of L4-S1. Pedicle screws were placed in the standard fashion. Bilateral laminotomy and medial facetectomy of L4-S1 were performed for decompression and exposure. After adequate decompression of the neural elements, the bone from laminectomy was compressed into the cages and placed within the interbody spaces of L4-5 and L5S1. Pedicle screws were then attached to lordotic rods and carefully compressed to restore lumbar lordosis. The facet joints were then decorticated, and grafted with the bone from laminectomy for posterolateral fusion. Neither the transverse processes of L4-S1 exposed, nor the intertransverse fusion intended during the operation. After surgery, the patient's symptoms alleviated obviously. Follow-up was ordered at 1 month, 3months, 6 months and 12 months after surgery.

Postoperative CT examinations were taken to identify the progress of solid fusion at the operated segments, and the solid fusion was observed 6 months after surgery. During the follow-up, we observed an interesting phenomenon: bony bridge passed through the patient's anomalous articulation region gradually, and finally, complete osseous fusion of the right L_5 transverse process to the sacrum developed. One year after surgery, according to Castellvi's LSTV classification, the patient transformed into an "acquired" Castellvi-IIIa sacralization from Castellvi-IIa sacralization without new complaints (Fig 3A-E).

Discussion

LSTV has been regarded as a common congenital anomaly of the lumbosacral spine.[1-3,6] In 1984, Castellvi classified LSTV into four types based on anteroposterior plain radiographs, which later became the most commonly accepted LSTV classification system: type I includes dysplastic transverse process (es) (a, unilateral; b, bilateral) with a width of 19mm or above. Type II exhibits anomalous articulation(es) (a, unilateral; b, bilateral) between sacrum and the enlarged transverse process (es). Type III exhibits complete osseous fusion of the transverse process (es) to the sacrum (a, unilateral; b, bilateral). Type IV includes a unilateral type II LSTV, along with a unilateral type III on the contralateral side.[7]To our knowledge, no literature had ever pointed out that LSTV types could be transformed from one to another after birth.

Our primary objective of fusion operation was to realize bony union at the intervertebral space and posterolateral region of the last two lumbar mobile segments following decompression. The purpose of postoperative CT examinations was to evaluate the fusion status of the operative segments. To our surprise, we found the pseudoarthrosis between the right L5 transverse process and sacrum disappeared gradually, and solid fusion was achieved there one year after surgery. So according to Castellvi classification system, the LSTV of this patient was transformed from type IIa to type IIIa. Till now, we did not see any report on that one type LSTV could change into another after birth. So we assumed there must exist links between the acquired transformation of LSTV type and the operation, although the operation did not touch the pseudoarthrosis region directly. The probably underlying mechanism might come from the immobilization at TD space after surgery, which made the osseous callus formation possible, and finally crossed the pseudoarthrosis.

However, we do not think immobilization only is sufficient enough to make anomalous articulation transform into complete bone union. If so, Castellvi-IV LSTV, which was composed by a unilateral Castellvi-IIa type along with a unilateral Castellvi-IIIa type on the contralateral side, would have a good chance for the anomalous articulation change into osseous fusion, because the Castellvi-IIIa side would immobilize the TD level. However, we did not see any report on that one congenital Castellvi-IV LSVT transformed into a Castellvi-IIIB one. Till now, almost all literature took it for granted that all LSTV types are congenital. Recently, Huang et al reported spontaneous spinal arthrodesis in patients with lower lumbar spodylolisthesis.[8] Whether spontaneous transformation to Castellvi-III LSTV from Castellvi-II LSTV could happen without fusion operation at TD space need further observation.

Our case indicated that after PLIF surgery at TD segment on a Castellvi-IIa Sacralization case, acquired transformation to Castellvi-IIIa might develop. Multiple factors might exist. However, the exact underlying mechanisms need further study.

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Figure 1. Digital radiography of lumbar spine indicated type Castellvi-IIa sacralization. (A)Standard anteroposterior radiograph, (B) extension lateral radiograph, (C) flexion lateral radiograph. Arrow indicates anomalous articulation between right hypertrophic transverse process of L5 ¬and sacrum. Arrow heads indicate change of L5S1 intervertebral space.

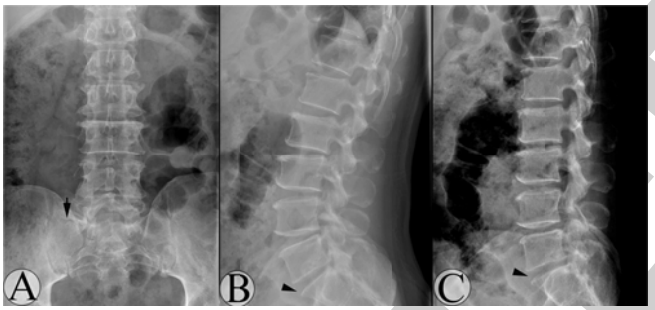

Figure 2. Transverse lumbar CT images identified disc herniations at L4-5(A) and L5S1(B) levels. Arrow indicates anomalous articulation between sacrum and hypertrophic right L5 transverse process.

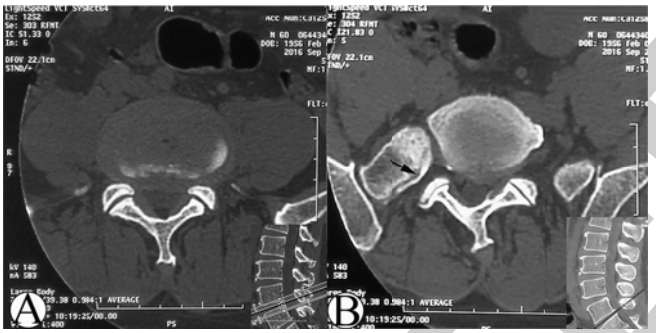

Figure 3. Postoperative CT reconstruction images showed the anomalous articulation fused gradually with time. (A) Preoperative coronal CT reconstruction. showing clear anomalous articulation between right L5 transverse process and sacrum. (B) One month after surgery, anomalous articulation space became a little vague, especially at lateral region. (C) 3 months after surgery, anomalous articulation space became vaguer with thinning of sclerotic bands. (D) 6 months after surgery, continuous osseous callus could be seen passing through anomalous articulation space with faded and sporadic disappearance of sclerotic band at bilateral sides; (E) 1 year after surgery, complete osseous fusion developed.