**EAS Journal of Radiology and Imaging Technology**
*Abbreviated Key Title: EAS J Radiol Imaging Technol*
ISSN: 2663-1008 (Print) & ISSN: 2663-7340 (Online)
Published By East African Scholars Publisher, Kenya

Volume-4 | Issue-6 | Nov-Dec-2022 | DOI: 10.36349/easjrit.2022.v04i06.005

OPEN ACCESS

**Original Research Article**

# Imaging of Bertolotti Syndrome

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**Article History**
Received: 26.09.2022
Accepted: 31.10.2022
Published: 28.11.2022

**Journal homepage:**
https://www.easpublisher.com

**Quick Response Code**

**Abstract:** Bertolotti syndrome is a congenital spinal anomaly characterized by an abnormal enlargement of one or both transverse processes (mega-apophysis) of the most caudal lumbar vertebrae that articles or fuses with the sacrum and/or iliac bone resulting in a pseudo-articulation. This is often a factor that is not addressed in the evaluation and treatment of low back pain. The presence of a lumbosacral transitional vertebra is a common finding in the general population with a prevalence between 4 and 30%. However, Bertolotti syndrome should be considered a differential diagnosis of low back pain. The pathophysiology, epidemiology and treatment should be the subject of general knowledge of physicians who often treat this disease.

**Key words:** Bertolotti syndrome, lumbosacral transition vertebra, low back pain.



## INTRODUCTION

The "Bertolotti syndrome," described in 1917, is characterized by the occurrence of low back or gluteal pain induced by the presence of a transverse megaapophysis of the last mobile vertebra that contacts the sacrum and/or iliac wing, sometimes forming an equivalent joint space there (third sacroiliac). Bertolotti stated that these abnormal vertebrae can produce lower back pain due to arthritic changes occurring at the site of pseudarthrosis. This not uncommon anatomical variant is reported to have an incidence of 4% to 21%. Recently, a very high incidence of 30% has been reported [1].

## MATERIALS AND METHODS

We conducted a retrospective study over a period of 34 months, from January 01, 2019 to October 31, 2021, from the files of patients referred for CT or MRI assessment in a context of chronic low back pain.

The criterion of judgment is the demonstration of a transverse mega-apophysis of the last lumbar vertebra, articulating with the sacrum.

The means of exploration used were MRI and CT scan.

Data processing was performed using Excel software.

## RESULTS

Five (5) patients were collected. The mean age was 39.06 years, with extremes of 18 and 76 years. 18 patients were female and 15 were male.

The CT scan showed in all patients the presence of a transverse mega-apophysis of the last lumbar vertebra, articulating with the sacrum and making an appearance equivalent to an articular interline (third sacroiliac), concluding in a Bertolotti syndrome. Osteoarthritic changes such as osteocondensation of the bony cortices and marginal osteophytosis were found in five patients. Degenerative disc disease such as disc pinching and global disc protrusions were found in four patients. A medial herniation was found in one patient only.

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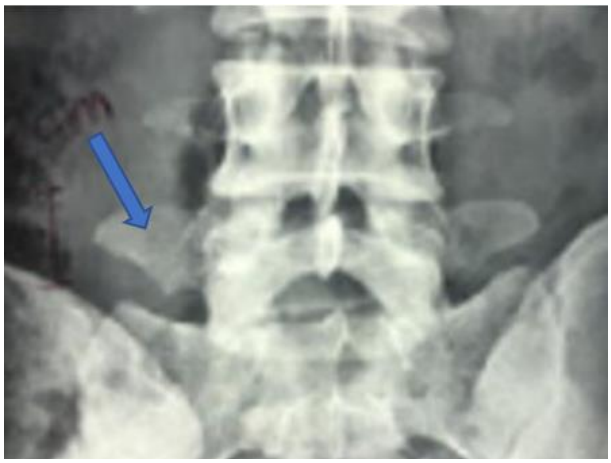

**Figure 1: Frontal X-ray of the pelvis : lumbosacral transitional vertebra, transverse megapophysis of L5 in a 40-year-old patient**

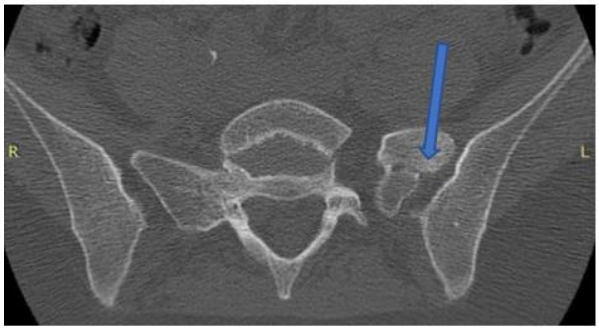


**Figure 2: Bone window axial CT section : transverse mega-apophysis of L5 articulating with the sacral fin in a 42-year-old female patient with chronic low back pain**

**Figure 3: Coronal reconstruction CT section in bone window: Neoarticulation between a lumbar transverse mega-apophysis and the left sacral fin in a 42-year-old patient with chronic low back pain**

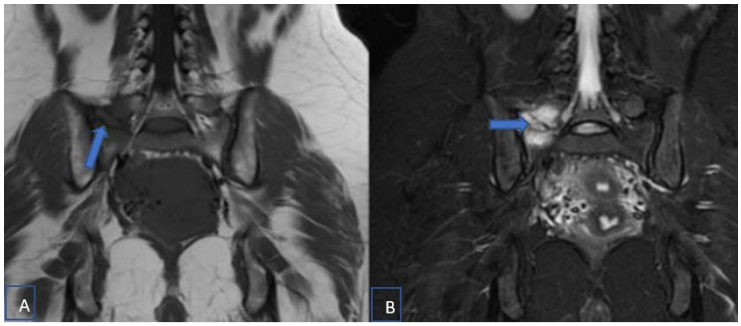


**Figure 4: Lumbosacral MRI: T1-weighted (A) and T2-weighted (B) coronal sequences of the demonstrates an inflammatory pseudarthrosis (arrow) between the right transverse process of the L5 vertebra and the right sacral**

# DISCUSSION

**Pathophysiology**

Two mechanisms have been proposed to explain the pain:

- A direct mechanism: related to a suffering of the neoarticulation. The fixations detected in scintigraphy opposite these neoarticulations in 80% of cases could be arguments in favor of this hypothesis, in particular, those highlighted by the SPECT-CT in symptomatic patients [2].
- An indirect mechanism: It has been suggested that the lumbosacral transition vertebra decreases degeneration of the annulus fibrosus of the disc below, without having the same effect on the endplates and nuclear complex.

An association was found between the presence of a lumbosacral transitional vertebra, disc herniations, and facet joint degeneration. Otani *et al.*, reported that a lumbosacral transition vertebra was found more often in patients with disc herniation (17%) than in the control group (11%) [3]. The discs immediately above the transitional vertebra have been shown to be significantly more degenerative (disc protrusion or extrusion) compared to the disc found between the transitional vertebra and the sacrum [3, 4]. Also, no ductal stenosis was found at the level overlying the transitional vertebra [5].

**CLINICAL**

The physical examination is often nonspecific. Patients may present with altered or limited range of motion between the transition vertebra and the sacrum generating facet joint pain and/or exacerbation of disc degeneration. The sign concerning the topography of the pain offering a fairly good compromise of sensitivity and specificity (a sensitivity of 71% and a specificity of 47%) is the "finger test" which consists of asking the patient to indicate with a single finger the site of his or her maximum pain, which would be more informative than the radiations. This sign is considered positive when the patient places his finger less than one centimeter below and medial to the posterior superior iliac spine [7].

Diagnostic imaging for pain typically includes:

a) Standard radiographs that demonstrate the transitional anomaly. Standard radiographs of the lumbosacral spine show the presence of an enlarged transverse process of the L5 vertebra that forms a neo/pseudoarticulation with the sacrum or iliac bone. Standard radiographs show an accuracy of 76% to 84% for the detection of a lumbosacral transitional vertebra (LSTV), however Ferguson radiographs (anteroposterior radiographs of the lumbosacral spine with a 30% cranial angle) show slightly greater sensitivity than standard AP radiographs for the diagnosis of LSTV. Profile images highlight transient lumbosacral anatomy, such as "quadrature" of the transitional vertebral body and reduction in height of the transitional disc. Axial images represent pseudarthrosis or fusion of the last lumbar vertebra with the sacrum [8].

b) CT scan is a complementary imaging tool that confirms the presence of the neoarticulation strongly suspected on standard radiology, it helps to define the bony structures, osteophytes, the state of the pseudarthrosis of the fifth transverse process. It allows the identification of areas of sclerosis and associated disc herniations [9]. It also allows to guide local infiltrations. In our observations, apart from the presence of the neoarticulation, we noted: a staged somatic and zygapophyseal osteoarthritis associated with marginal osteophytes, signs of degenerative disc disease in the form of disc protrusions with indentations on the anterior epidural space.

c) Magnetic resonance imaging (MRI) is the examination of choice, as it has a sensitivity and specificity of 80% for diagnosis [4]. It is useful for highlighting any bone edema around the inflamed pseudarthrosis [10]. It will provide similar data to the CT scan with a more detailed root and disc study (Figure 2, 3).

d) Bone scan can be useful in young patients in case of suspected stress pathology in the transverse-sacral joint or stress injury in the pars interarticularis. It helps in the implementation of therapeutic measures [4]. It will reveal hypermetabolic areas in the form of isotope-hungry foci [11].

Castellvi *et al.*, in 1984 proposed an imaging classification:

- **Type I:** An enlarged L5 transverse process, not clinically significant,
- **Type II:** Has incomplete uni- or bilateral lumbarization/sacralization with an enlarged transverse process that has a diarthrodial joint between itself and the sacrum. Formation of a unilateral or bilateral diarthroidal joint between the enlarged transverse process and the sacrum,
- **Type III:** Describes a unilateral or bilateral lumbarization/sacralization with complete bony fusion of the transverse process(es) to the sacrum,
- **Type IV:** Involves a unilateral type II transition with a type III on the contralateral side.

**TREATMENT**

A variety of therapeutic approaches are available, including percutaneous injection of anesthetic and steroid drugs under radiological guidance, radiofrequency ablation of the neo joint, surgical fusion

of the pseudoarthrosis, and osteotomy of the expanded transverse process [12]. An extended surgical approach will be required in patients with persistent pain. New techniques such as 3D guided surgery and minimally invasive procedures can be applied to this condition with good results [13].

## CONCLUSION

Bertolotti syndrome is a congenital transitional anomaly of easy diagnosis based on the presence of a transverse megaapophysis of the last lumbar vertebra that articulates with the sacrum and/or the iliac wing, and is responsible for low back pain, but poses a therapeutic problem given the possibility of recurrence of pain. Large-scale randomized controlled studies are needed to establish an effective therapeutic protocol.

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**Cite This Article:** A.F. Achta, O. Hamdaoui, M. Banao, N. Touil, H. Tabakh, A. Siwane, C. Kacimi, N. Chikaoui (2022). Imaging of Bertolotti Syndrome. *EAS J Radiol Imaging Technol, 4*(6), 139-142.